THE ARCHITECTURAL FORUM

IN TWO PARTS

PART ONE

ARCHITECTURAL DESIGN

MAY

1929

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Profile and close-up of a section of the wall panel and chair rail used in the interior shown above.

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PERIOD MOULDINGS
in ornamented wood

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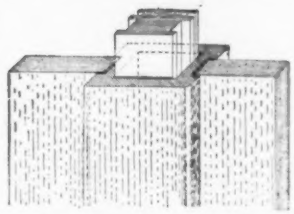
And it happens that the most beautiful partition is also the most practical



A section through the post used in New Telesco Partition, showing the substantial construction. It shows how the standard sections of the partition are held in place. No flimsily fastened pilasters and base blocks, but one solid piece of cabinet work. The telescoping post is shown inside.

Typical installation of Telesco Partition in the New York Life Building, New York City

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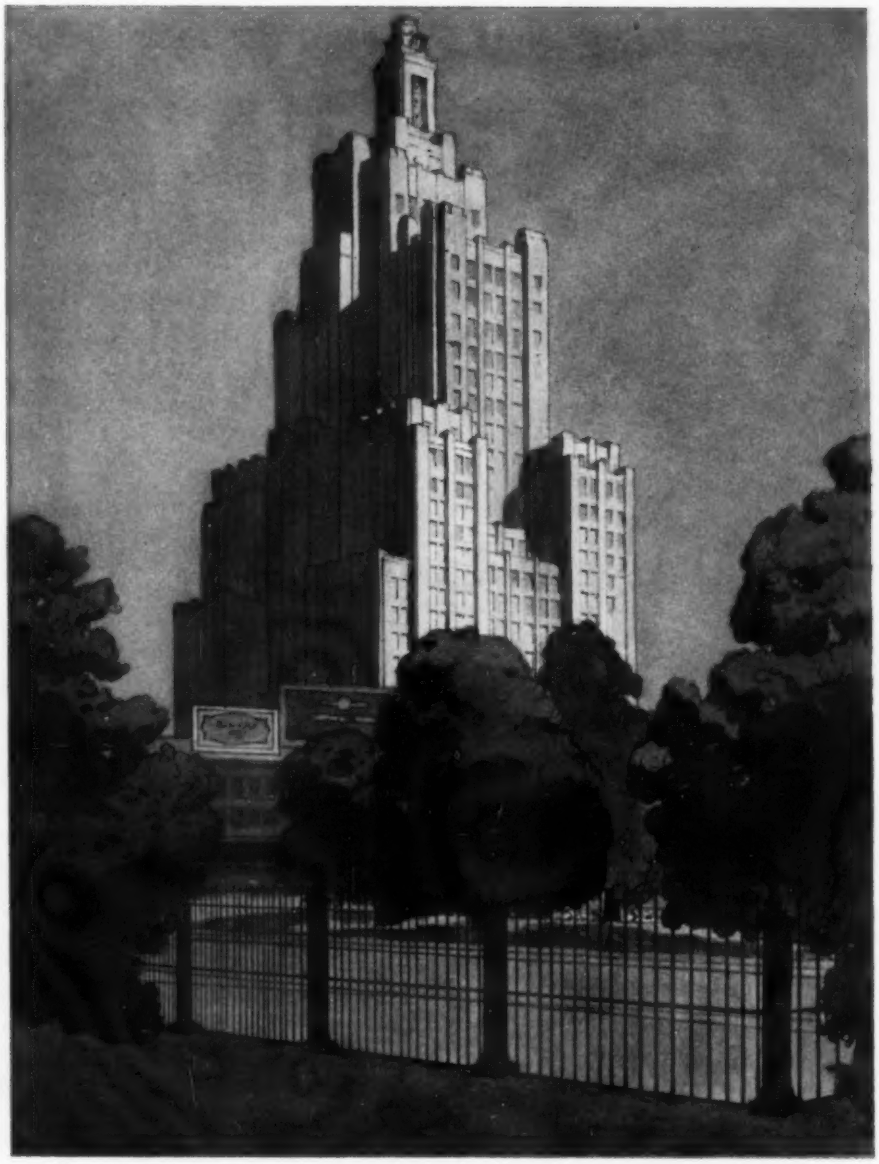


INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE

WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT

From a Water Color Drawing by Norman C. Reeves

THE
ARCHITECTURAL
FORUM

VOLUME L. NUMBER FIVE

MAY 1929

INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE

WALKER & GILLETTE, ARCHITECTS. GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT.

BY

M. P. GREGORY

FEW passengers on the trains which go from New York to Boston fail to see the tall "modern looking" skyscraper recently erected across the plaza from the railroad station in Providence. It would be noticeable anywhere, but in a New England city it is particularly striking, rising as it does to a great height over the surrounding country and towering far above the other buildings near it. This new addition to the skyscraper family is the home of the Industrial Trust Company, though in its upper reaches, and seemingly swung in mid-air, are the offices of firms of various sorts. The directory of the building is a fairly representative cross section of the prosperous business activities of the community.

There are countless elements to be considered in judging the architectural merits of a building of this general character,—the uses for which the structure is intended; the economic conditions governing the site and type of building; the point of view of the executives of the bank; the available resources; and, last but not least, the point of view of the designers. This large and soaring structure came as a result of a logical consideration of the first two elements mentioned. Housing for a large bank was a primary requisite, with accommodations for a number of good-sized offices with air, light, and spaciousness. The cost of land in any necessarily central location in Providence was prohibitive. It is not only in Providence that the answer to that combination of requirements has been a skyscraper. That advertising power and publicity were considered as active factors seems likely. That they are successful factors is attributable to the advantage taken of the site by the designers, but it is well to bear in mind that the modern and much maligned skyscraper silhouette is here justified, not as a publicity stunt but as a matter of design.

On closer examination of the exterior, one finds that what detail there is, is more or less conventional. The architects, Walker & Gillette, were fortunate in one respect. They did not have to bring a towering weight of stone to rest on a foundation of glass shop fronts, as is the case with most of the great hotels and commercial buildings in New York. The weight of this structure is carried to the ground visibly and in a logical manner. The building is actually 26 stories high, and its steel bones are sheathed with honed limestone, which has something of the texture of concrete, with the color and richness of the natural stone. The base is made more solid and substantial by the use of granite which harmonizes well with the limestone and gives added character and richness to the building's exterior.

From the west,—from the railroad station,—one approaches the building across an open park and a broad street. From the east one becomes conscious of it as a vertical mass shadowing a narrow, crowded thoroughfare. These facades, both of equal importance, are identical save for the subject matter in the carved reliefs, which, appropriately enough, give a series of scenes from the history of Rhode Island. This same interrupted band of flat sculpture is carried around the south side of the building also; to the north, however, adjoining buildings take away the wall space, and there an arcade is incorporated in the building, running straight through the structure and giving the public access to the general offices in the building without passage through the bank.

Throughout the building there is evident the lavish and successful use of materials. On entering the Industrial Trust Company's main banking room this fact undoubtedly contributes to the reassuring consciousness one has of ease and well being. The entrance hall is really a landing stage between the savings department of the bank, which is below the level of the street, and the main room, a short flight above. Here is an example of how a limitation imposed on an architect can often be successfully surmounted and lead, as in this instance, to an interesting and original innovation. This feature is not brought out very clearly in the illustrations, but it is a very ingenious solution of a difficult problem.

Photos. Sigurd Fischer

Main Banking Room, Industrial Trust Company Building, Providence

It converts an awkward situation into a convenience, and does not detract too much, artistically speaking, from the approach to the main area.

This main room is quite as impressive as it was intended to be. Massive marble columns extend down the lofty room; they are elevated for added dignity and height on square pedestals. Here, as in the exterior, there is a compromise between the traditional and the modern style in architecture. The blending is so skillful that it is hard to say where one leaves off and the other begins. One might say it was Empire "with a difference." Most of the detail undoubtedly had its original inspiration from the Greek, with many variations, additions, and attenuations. But the temptation to analyze and search for origins is usually futile, even if irresistible. The success of this room is largely a question of the use of restraint and a skillful harmonization of color. The accompanying illustrations of course fail completely in showing this and in doing justice to the room, and this must be borne in mind when looking at them. The illustrations also fail to give the impression of loftiness which one receives on mounting the steps from the entrance, and they give a false effect of spottiness and unrest. The room is quite adequately lighted by very tall wide windows at either end. A clever combining and matching of marbles has had much to do with the success of the room, and advantage was taken of the different light effects on slabs placed horizontally and vertically. The wall lining of the entrance hall, some of the inserts in the paving of the banking room, parts of the counters and the 16 columns are of gray marble. In the columns the marble is a cloudy black and in the paving and in the hall there is a pearl-gray cast to it. The Empire feeling of the room is attributable to the black and terra cotta color scheme and to the details. The columns are Ionic and of the barest simplicity, carrying a much compressed architrave free from all decoration save medallions. These coin-like medallions with black silhouetted profiles, and the large saucer-shaped medallion with the signs of the zodiac which decorates the ceiling have as a background the terra cotta red of Greek vases.

Medallion in Ceiling of Main Banking Room

The figures are not the least modern in either feeling or execution. This terra cotta color is used not only in the upper part of the room but finds an echo in the inserts of red marble used in the pavement, and in a band or frieze below the top shelf of the tellers' cages. These "cages," no longer cages in modern banks, but railed off counters, line up along each side of the room, and are designed for accessibility and harmonization, again in a very restrained and simple design. The bronze grille has been given a gun metal finish which repeats the luster of the columns and of the counter. Four of the 16 columns are slightly engaged in a partition wall, and though one regrets this necessity, the best has been made of the difficulty. A description of the room is not complete without mention of the lighting fixtures, which carry out in miniature the skyscraper outline of the building,—not in detail, but in shape and feeling. This device is something like a motif or key which prevails throughout the public parts of the bank and which testifies to the attention and care which have been lavished on the building's details.

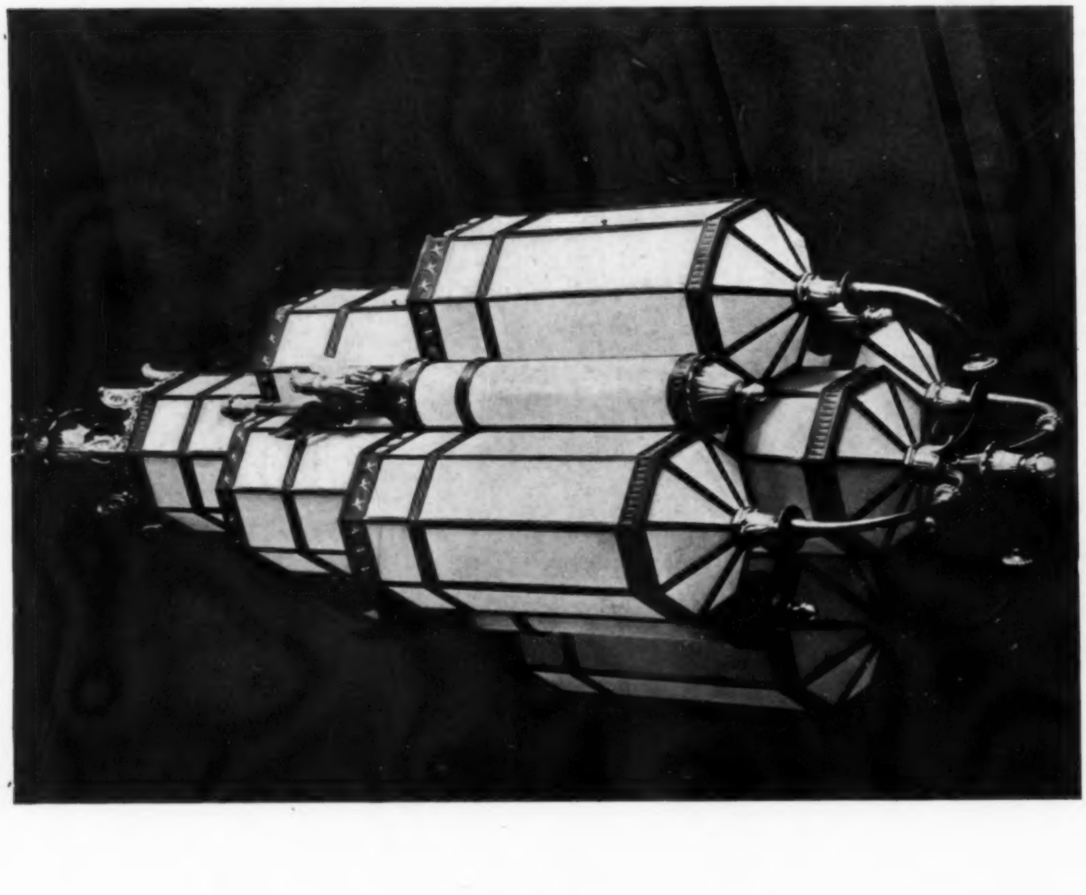
If, as has been said, the purpose of fine architecture is to enclose space, to enhance consciousness and submerge personality, then this room fulfills in some measure such a purpose. The architects are, to be sure, met more than half way by the requirements of modern banks for spaciousness and rich accessories, and by their willingness to spend large sums of money to attract and please the fickle public. So that where the Greeks found an opportunity for full expression in design in the wealth provided for their temples, the Byzantines and the early Christians in the coffers of the Church, and the architects of the Renaissance in the patronage of vain and wealthy princes, so the modern bank designers find opportunity from the rich returns of an investing public.

The savings department on the lower floor is less interesting, and of course less magnificent. One has a crowded feeling, partly due to the low ceiling and the restricted window space. A curiously etherialized symbol of an Ionic cap reduced to its lowest and simplest terms is used on the square piers, and we have come a long, long way from the Parthenon when lighting fixtures in the cornice are hidden behind the translucent

Clock in Main Banking Room

panels of what would have been the sculptured triglyphs of a Greek temple! The offices of the directors of the bank and the directors' room are above the main bank. Here one is no longer in a public hall, and there are rugs and paneling and fireplaces. There is a large, low-ceiled outer room, paneled in stained butternut, with a plaster cornice coffered deeply along the lines of the steel ribs. The room creates a calm feeling of rest and well being. In the directors' room all thought of modern architecture has been abandoned, and one enters a thoroughly conservative,

SIDE ENTRANCE
INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT



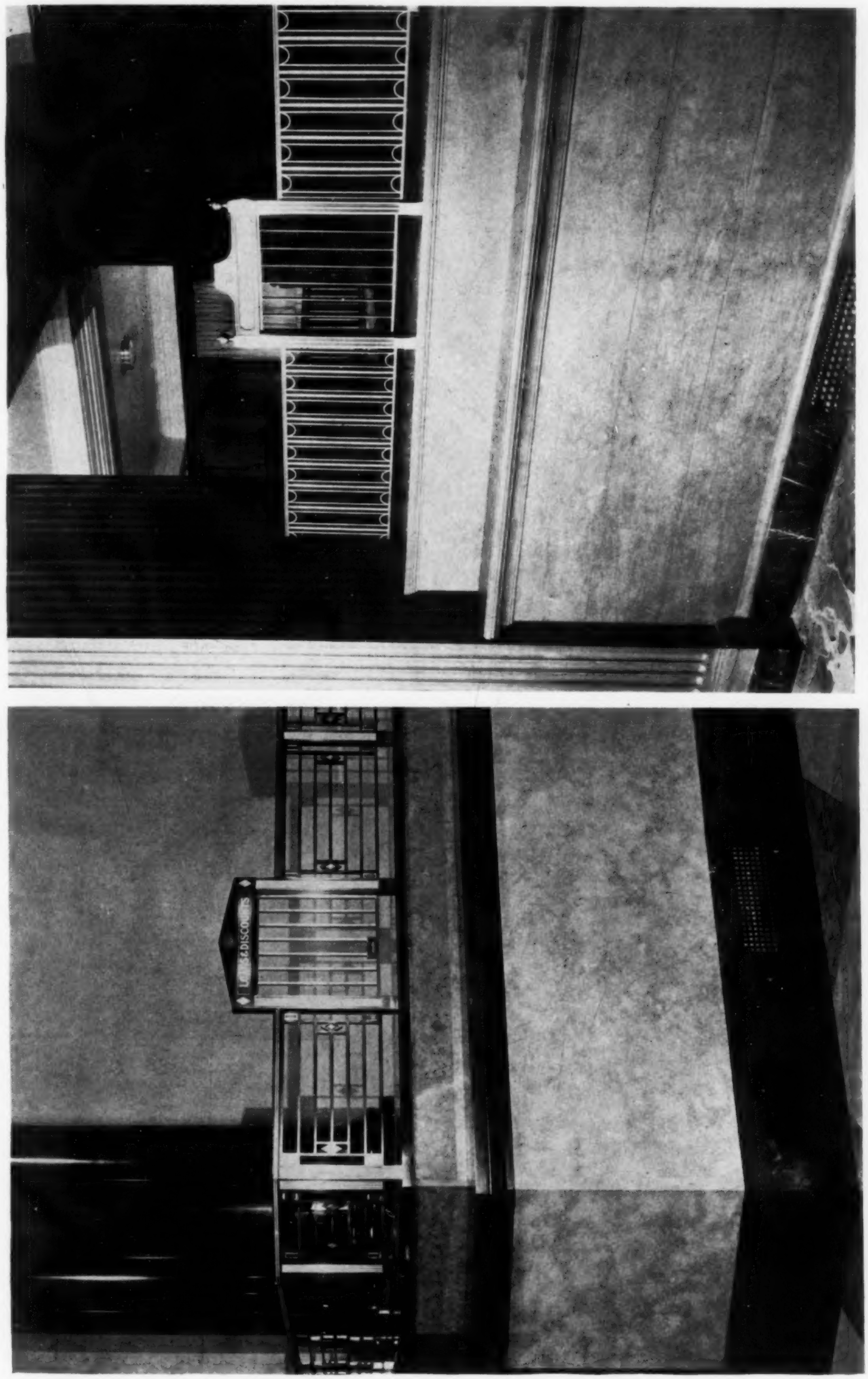
LIGHTING FIXTURE IN MAIN BANKING ROOM

CARVED RELIEF, MAIN ENTRANCE

INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE

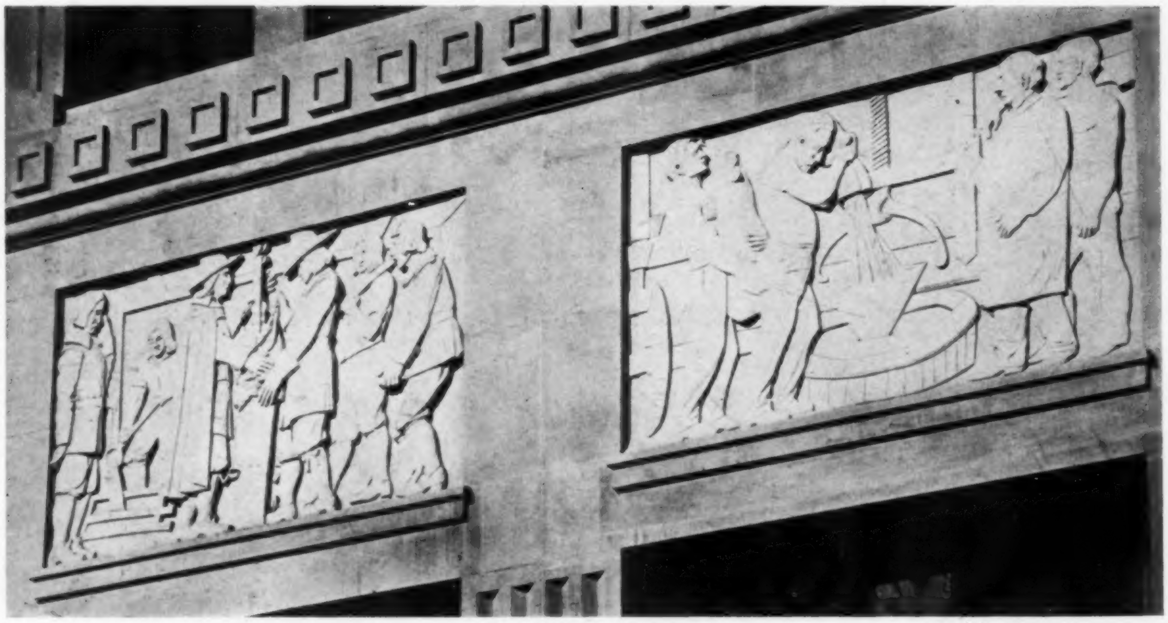
WALKER & GILLETTE, ARCHITECTS

GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT



COUNTER SCREENS
INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT

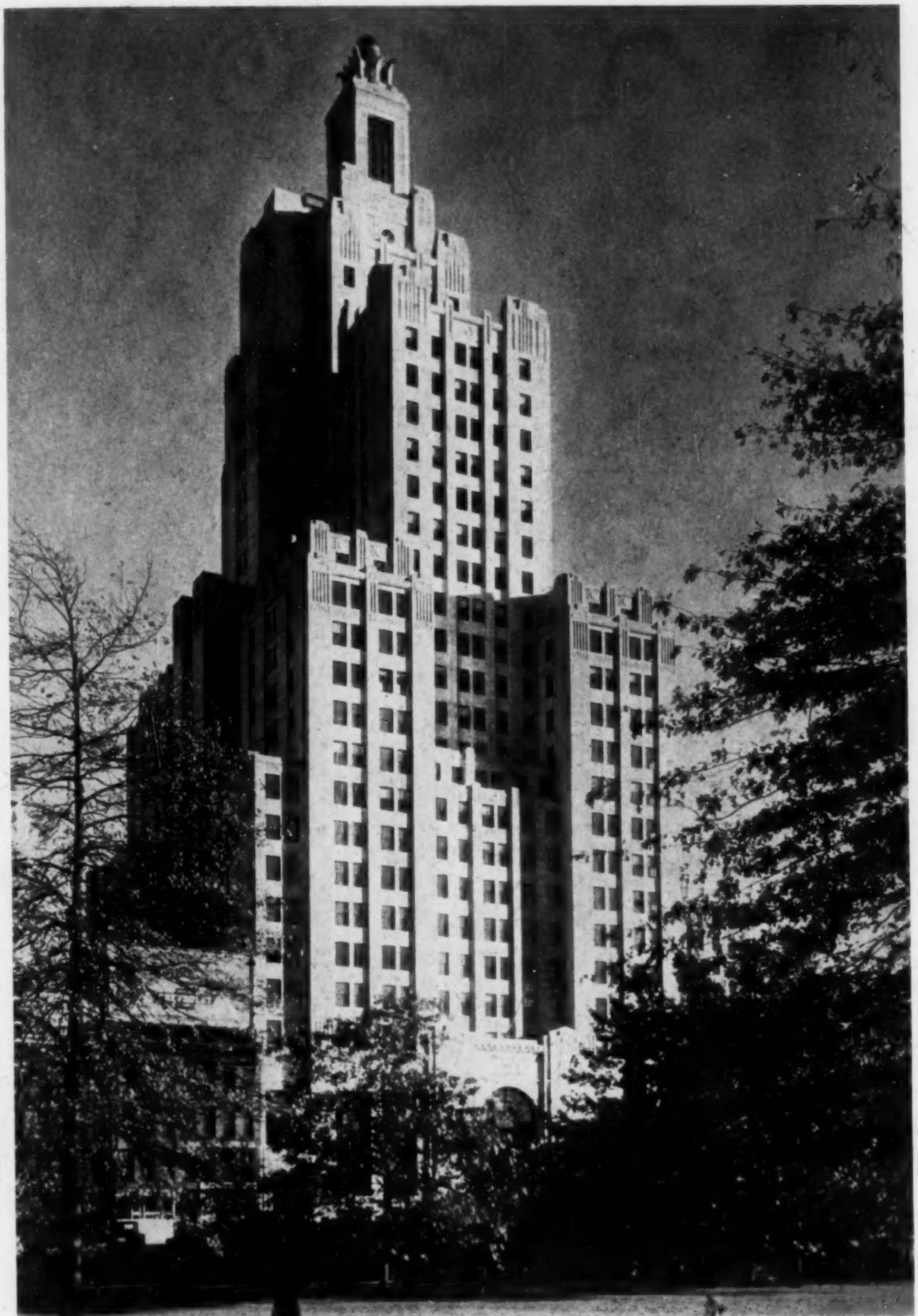
Marble Column in Main Banking Room



Carved Relief on Principal Facade

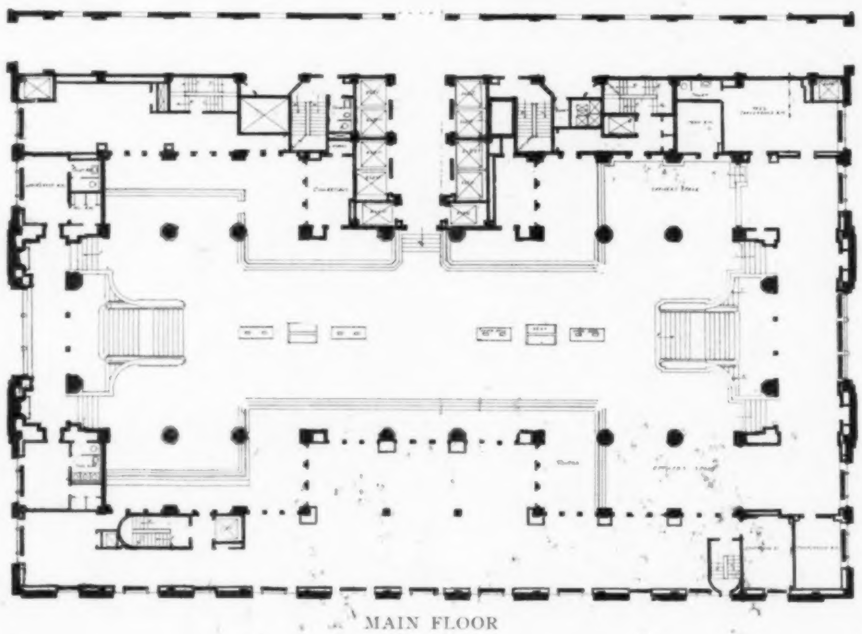
Georgian room—oval, paneled, and painted white.

Below the rooms already described is the steel-encased safe deposit vault, one of the largest in the country. From the boiler room to the top floor, all needs seem to have been thought of and analyzed, and due provision has been made. The logical restrictions imposed by the bank directors have been met and solved by the architects in an efficient and satisfactory manner. Even details such as furniture and decorations have been specially designed and selected by the architects, the entire effect being dignified and architectural.



Plan on Back

INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT



MAIN FLOOR

PLANS. INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE

WALKER & GILLETTE, ARCHITECTS

GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT

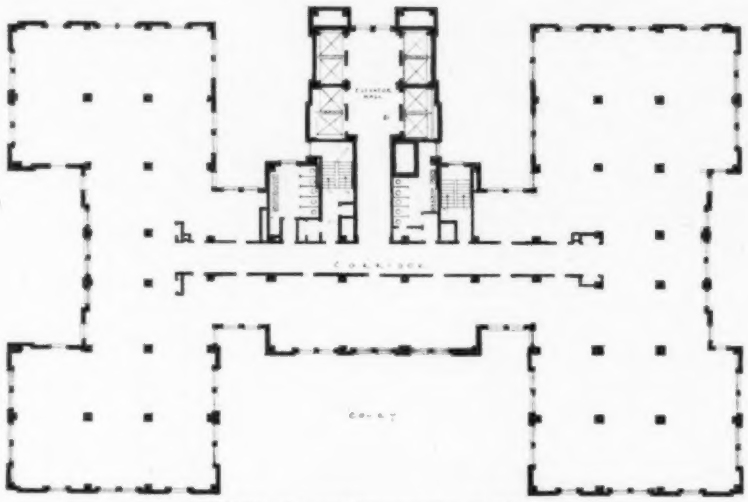
Plans on Back

MAIN ENTRANCE DOOR

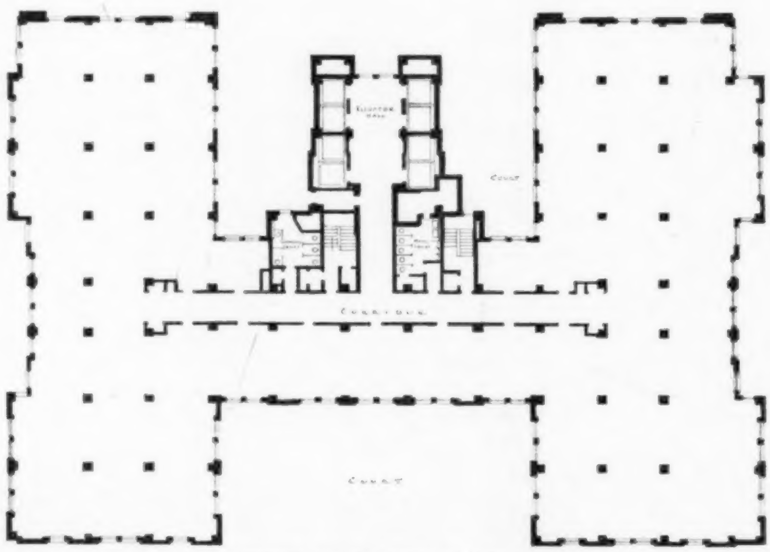
INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE

WALKER & GILLETTE, ARCHITECTS

GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT

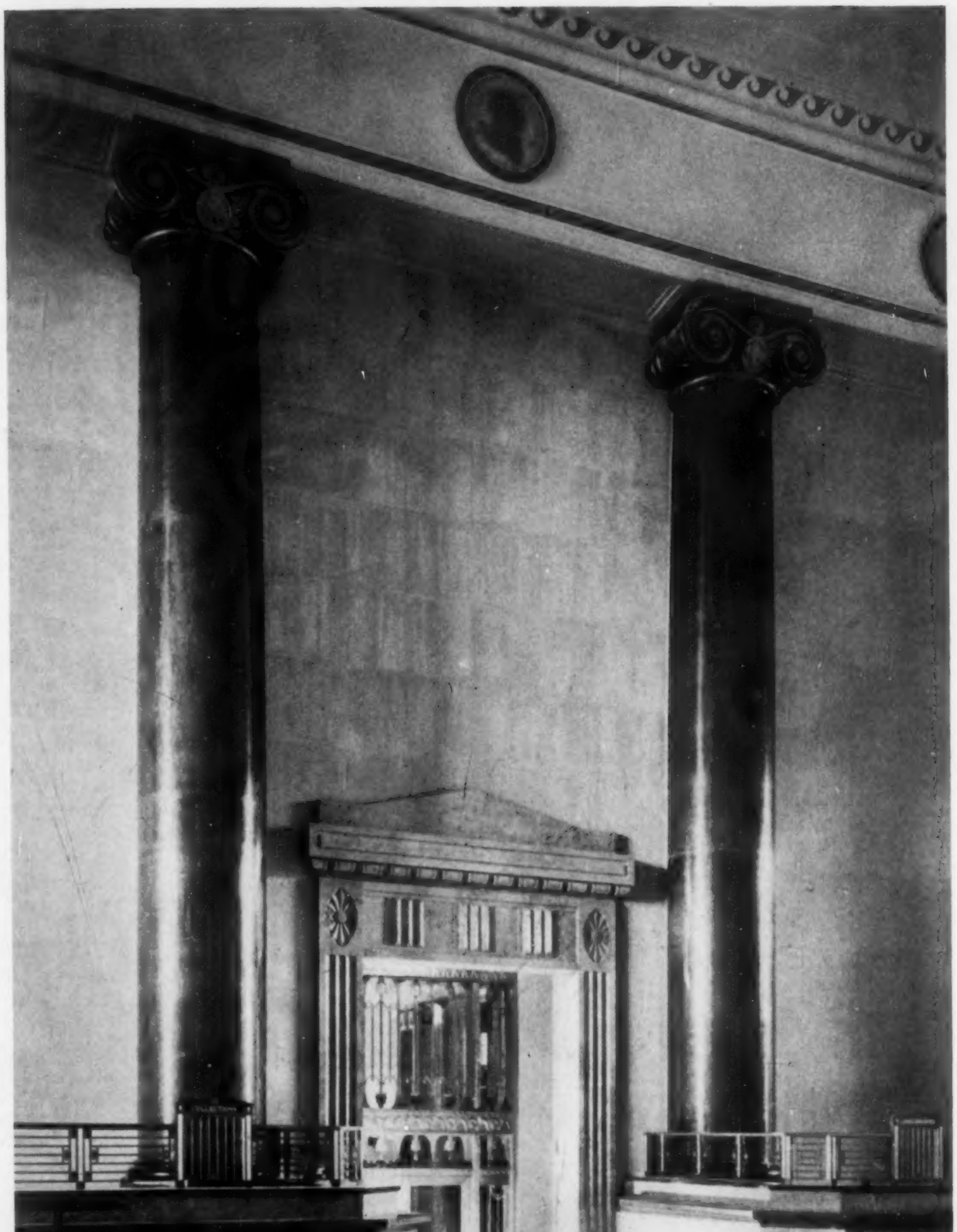


TENTH TO THIRTEENTH FLOORS



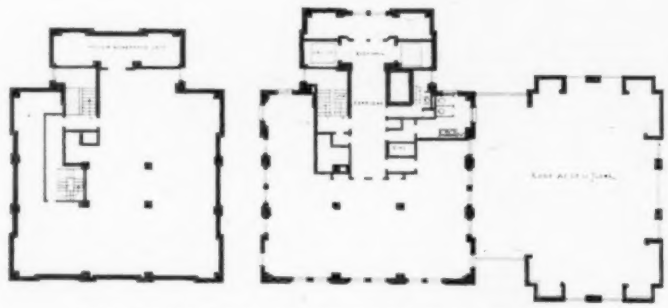
FIFTH TO EIGHTH FLOORS

PLANS. INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT

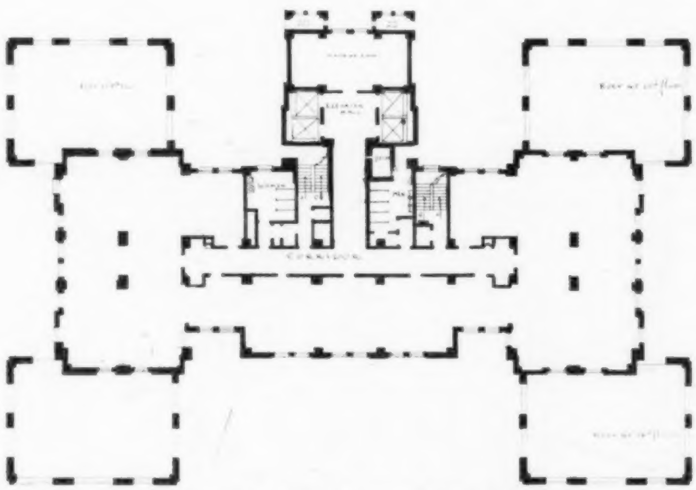


Plans on Back

DOOR BETWEEN MAIN BANKING ROOM AND SAVINGS DEPARTMENT
INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT



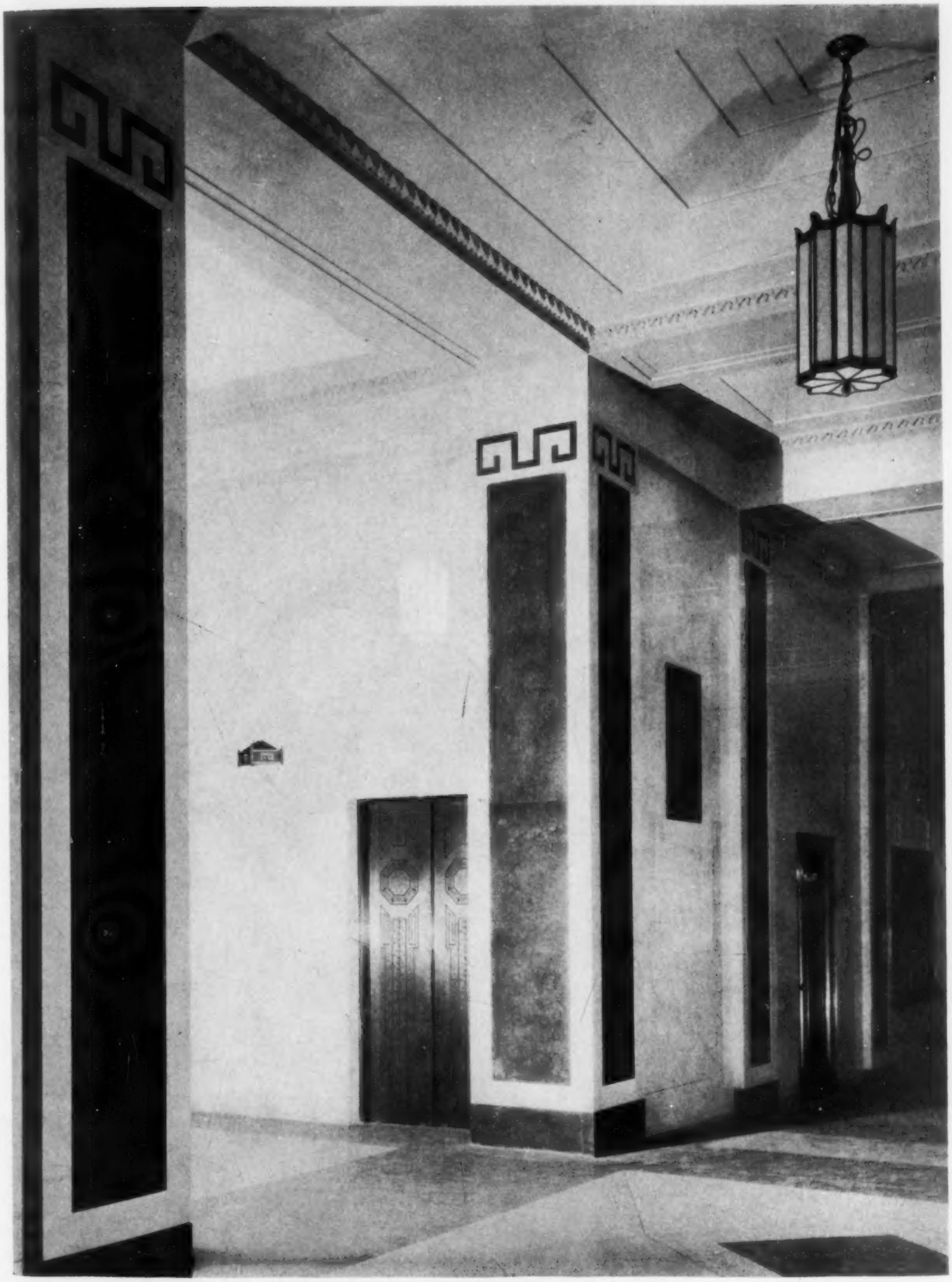
TWENTY-SECOND TO TWENTY-SIXTH FLOORS



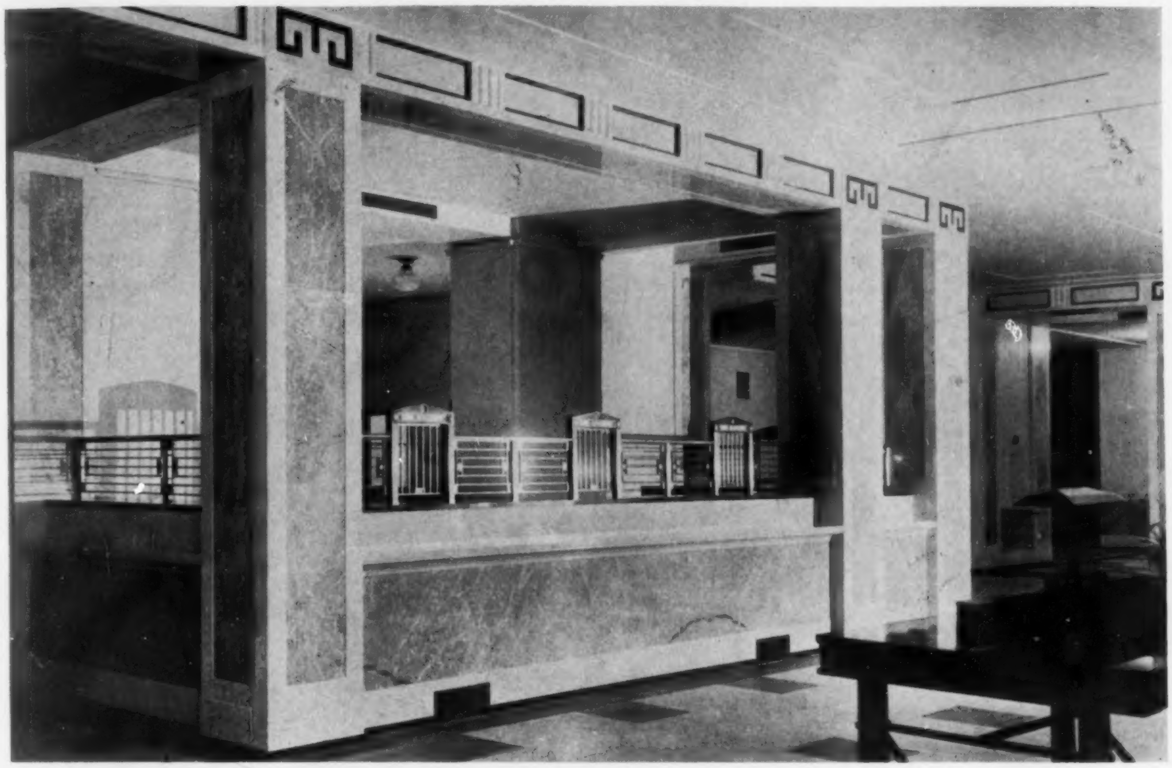
FIFTEENTH TO TWENTY-FIRST FLOORS

PLANS, INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT

MAIN BANKING ROOM
INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT



DETAIL OF MAIN CORRIDOR
INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE
WALKER & GILLETTE, ARCHITECTS
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT



SCREEN, SAVINGS DEPARTMENT, LOWER FLOOR

OFFICERS' AND INVESTMENT ROOM

INDUSTRIAL TRUST COMPANY BUILDING, PROVIDENCE

WALKER & GILLETTE, ARCHITECTS

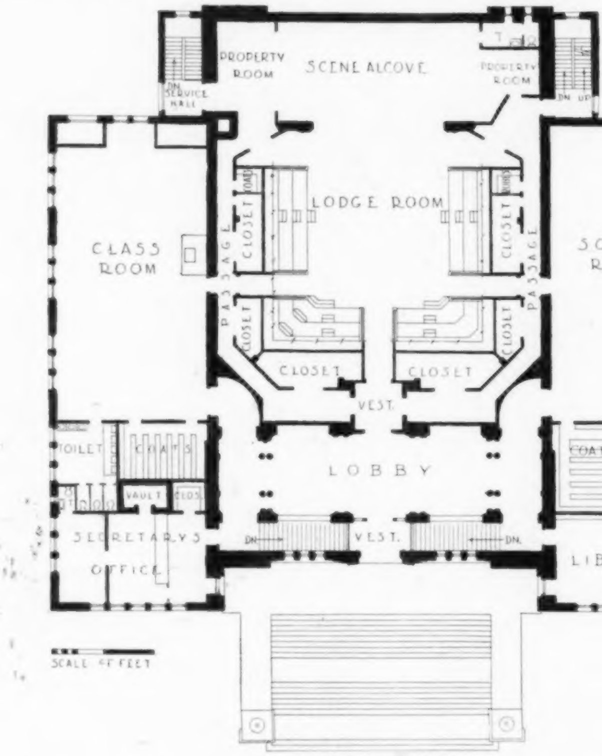
GEORGE FREDERIC HALL, ASSOCIATE ARCHITECT

Photos. Tebbs & Knell, Inc.

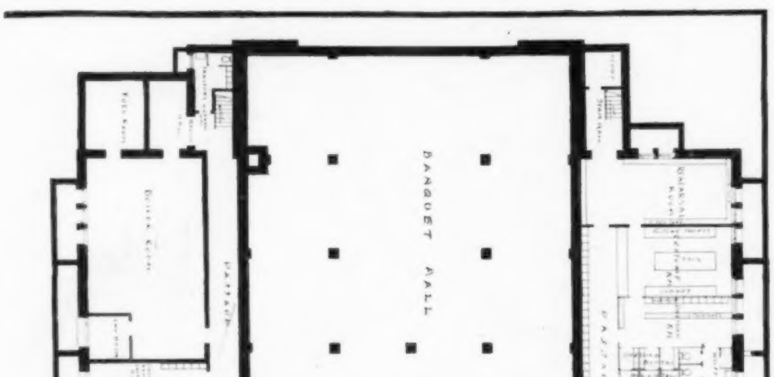
Plans on Back

SCOTTISH RITE TEMPLE, MONTGOMERY, ALA.

H. W. WITCOVER, ARCHITECT



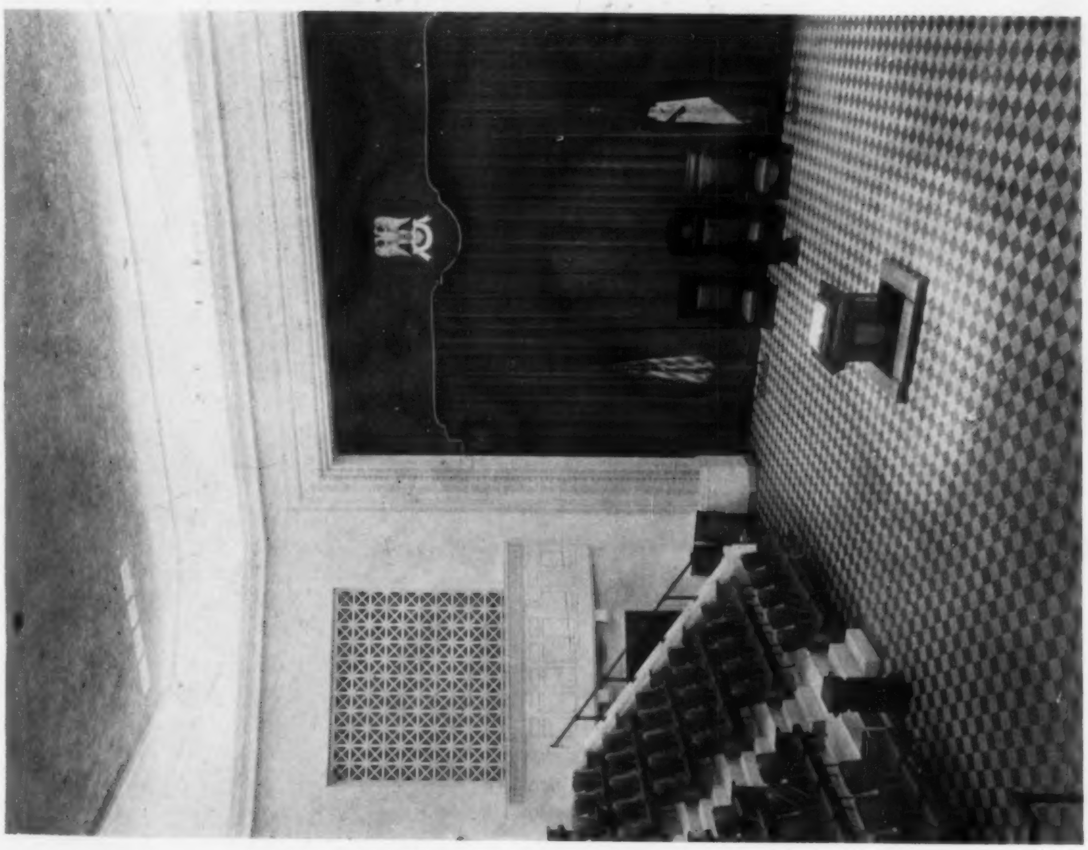
FIRST FLOOR



BASEMENT

PLANS, SCOTTISH RITE TEMPLE, MONTGOMERY, ALA.

H. W. WITCOVER, ARCHITECT



LODGE ROOM

ENTRANCE LOBBY

SCOTTISH RITE TEMPLE, MONTGOMERY, ALA.

H. W. WITCOVER, ARCHITECT

THE CHAPEL AT ST. GEORGE'S SCHOOL, NEWPORT

CRAM & FERGUSON, ARCHITECTS

BY

MATLACK PRICE

STUDENTS in the older English schools and colleges, such as Oxford and Cambridge, have been fortunate in the architectural environment in which they spent their most impressionable years. The time of the foundation of those schools and colleges was a period when the prevailing architectural tendencies were fine. With us, school and college environments must be good through design, rather than because of fortuitous circumstances. When most of the buildings of our universities were built,—during the last century,—taste in this country was at a low ebb,—very low. It is only in recent years that taste, in the hands of our more able architects, has done its best to repair the æsthetic mistakes made in the buildings of the 1870's and the 1880's. It was Mr. Cram who once said that the era of the Philadelphia Centennial of 1876 found us, "architecturally, the most savage of peoples."

The American boarding school presents, in miniature, something of the architectural problem of a college or a university, since its activities are, on a smaller scale, quite similar. And in the dream of every school's future there is a complete plan, with dormitories about quadrangles, a library, a refectory, a gymnasium and various other special buildings. It is a dream already realized, in large measure, by St. George's School at Newport. This is a school which has built its history rapidly since its opening in Newport, and there, on a broad hilltop overlooking the Atlantic, the first of the present buildings was erected. The school was incorporated under the laws of Rhode Island in 1900 and re-incorporated in 1907. It was prior to 1907 that the second school building was added to the first,—a structure which combined schoolroom, gymnasium and sixth form living quarters. Gradually the school grew, though not in accordance with the original architectural plan, which grouped various buildings about a quadrangle, with the first building on its north side. Since the magnificent view from the hilltop site is to the south and east, it was deemed unwise to block this, and the buildings which have been added from time to time have been placed to the north and west, except the refectory, which is east of the original building and a little north of it. In the airplane view, shown on page 662, the entire school group is to be seen in its relation to the chapel. From Newport the school is plainly visible on a hill between the two beaches, and far away across Easton's Pond there is the tall square chapel tower, its four pinnacles rising high above the older buildings. The effect is not unlike that of an English cathedral town seen from a great distance, since the elevation of the site, and the scale of the tower in relation to the other buildings create an illusion of greater than actual size.

The chapel, one of the most recent as well as one of the most beautiful works of Cram & Ferguson, lies thus to the compass: the long axis runs east and west; the south elevation faces the old school; the east elevation consists mainly of the sanctuary window, and the north elevation shows the length of the choir-nave and one end of the ante-chapel, above which rises the tower. Except for the tower, there is no west elevation, for at this end the chapel adjoins one of the school buildings, which is, in effect, a not very stylized version of brick-and-stone Tudor,—the character, in fact, of the entire school group, to which the chapel adds Gothic. The plan of the chapel is simple, and should be studied not only in itself but in relationship to its connection with the existing school buildings to the south. It consists of the sanctuary, seen at the end of what would ordinarily be a nave, but which in a school chapel combines nave and choir, in order to seat all the students apart from such visitors as may be seated in the ante-chapel, which occupies the transept, on the transverse axis. Along the south runs a cloister, which leads on the west into the ante-chapel and on the east into the statio or vestibule between the sanctuary and the old school chapel, now the lady chapel. It is this south side which is to be joined to the buildings to the south by two new cloisters, running north and south, with a library over one and sacristies and choir and practice rooms over the other. The fourth side of the cloister garth thus formed will be the present covered walk leading from the old school building to the refectory. When this has been accomplished, the chapel will assume its planned and proper architectural relationship to the earlier school buildings, and the south elevation will show the architects' intention regarding this side.

St. George's School Chapel is such a fine and complete example of the work of Cram & Ferguson that it is more than tempting to make a study of the iconography of both its exterior and interior, if for no other purpose than to renew our appreciation of the charming facility of the Gothic manner for telling stories and preserving symbolism, and to realize anew how much, by scholarly knowledge and studious design, there may be built into a structure of this kind. Before beginning such a detailed study, however, it is interesting to record something of the architects' gen-

Airport View, St. George's School, Newport

eral premises, something of their *credo* in the matter of church architecture in general, as told to the writer by Mr. Cram. He believes that, whatever else is done, the continuity and traditions of the old churches must be preserved, whether they be Roman Catholic, Anglican, Greek or Hebrew; that the architect must hold to the unchangeable things at the same time that he thinks of them as modernly as the present age may suggest. This preservation of continuity, this consistency, need not, and indeed should not, mean mere copying, and least of all the sort of copying so unintelligently imputed to Mr. Cram by some of his critics. Authentic thought is more important, in the end, than mere pedantry. Mr. Cram, indeed, holds a brief for eclecticism when he says that a Renaissance reredos in a Gothic church would do no violence to his feelings, provided that it expressed something of the growth and evolution of the building. Mr. Cram reminded the writer that his firm regards the Gothic manner as having never died a natural death, but rather as having been supplanted violently by the spirit of the Reformation and by the works of the "pagan" Renaissance. Cram & Ferguson, Mr. Cram says, are carrying on with Gothic from the point at which it was unnaturally stopped, and with this vision of the style, they believe that its place is with living expressions, and that it is not to be regarded as merely archæological, and hence lifeless, but as a finely articulated architectural means of creating such buildings as St. George's School Chapel. Be the humanism of the Renaissance what it may in terms of architecture, there is no greater humanistic expression known that the intricate symbolism allowed by Gothic design, nor any means better suited to the incorporation of both historic and contemporaneous imagery in the very stones of the building.

St. George's School Chapel is not only an important addition to the distinguished achievements of Cram & Ferguson, but is, further, a monument to a perfect accord and unity in ideals and the working out of every detail as between the architects and John Nicholas Brown, the donor of the chapel. Throughout the work Mr. Brown was in close touch with the whole undertaking and unsparing of time, coöperation and enthusiasm. Closely associated, too, with the success of this building, was Chester Brown, of the office of Cram & Ferguson, upon whom rested that responsibility for details both major and minor to be appreciated only by the practicing architect.

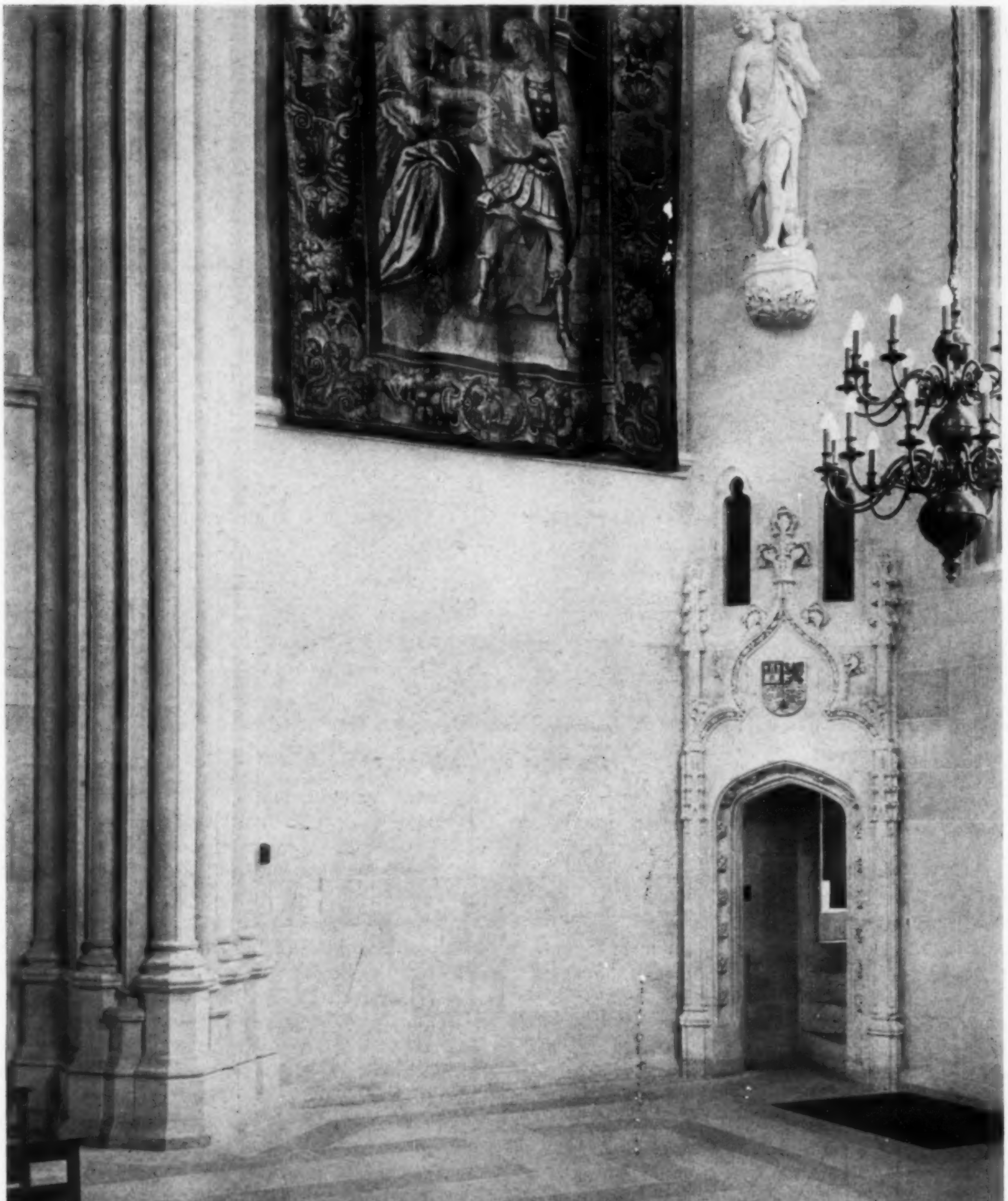
With this survey and introduction to the building as a whole, there remains for study the detailed interest of its iconography, both without

St. George's Chapel from the Quadrangle

and within. Let us suppose that we approach the chapel from the drive along its north side, where we may appreciate its frank and yet ingenious joining to the old school building. The brick-and-stone Tudor manner of this is recognized by the small polygonal turret, crenelated, with panels of brick and English flintwork combined with the stone of the chapel,—a transition far from abrupt, even without the aid of the ivy which will one day cover the walls of both. Between this small turret and the turret containing the tower stair there is a door opening into the ante-chapel and the old school building, a door surmounted by a figure of St. George and the dragon. The moulding stops are grotesque figures symbolizing school athletics,—football and baseball. Projecting from the top of the stair turret, which rises a little above the end of the transept, are six gargoyles, and beneath these, at the junction of the window label mouldings, are six heads, carved of stone, portraits of John Nicholas Brown, Messrs. Cabot, Nevins and Peaslee, of the school, and Ralph Adams Cram and Chester Brown, of Cram & Ferguson. The north transept window is surmounted by a figure of the Virgin and Child, in a niche, and the label moulding stops bear symbols of virginity,—the unicorn and the burning bush. The baptistry window is in the short east wall of the north transept, and its moulding stops are a sea horse and a shell. Above them is a water spout carved in the form of a school of dolphins, completing the symbolism, at this point, of the nearness of the chapel to the sea.

Above the ante-chapel rises the tower, a thoroughly fine and beautiful piece of design, recalling in its manner England's old Merton College. Those who favor casting all old precedent into the scrap heap in favor of something,—anything,—"modern," might be invited to look at this tower before they become too sweepingly radical. Its combined strength and grace, true to its style, will certainly successfully challenge the centuries, as, indeed, the Gothic towers of the middle ages have so far done by their sheer architectural excellence. This is a tower with a bell deck screened by open mullions and tracery, with pinnacles and pierced crenelation against the sky. Below the bell deck are shields of Connecticut, Jerusalem, Antioch, Alexandria, Rome, Constantinople, Canterbury and St. Andrew's. In the spandrels of the bell deck openings are carved figures to symbolize some of the liberal arts,—philosophy, music, astronomy, arithmetic, geometry, rhetoric, and grammar.

Returning, again, to the north elevation, there is the architects' door, a finely organized unit of design, with its delicate buttresses, its pierced

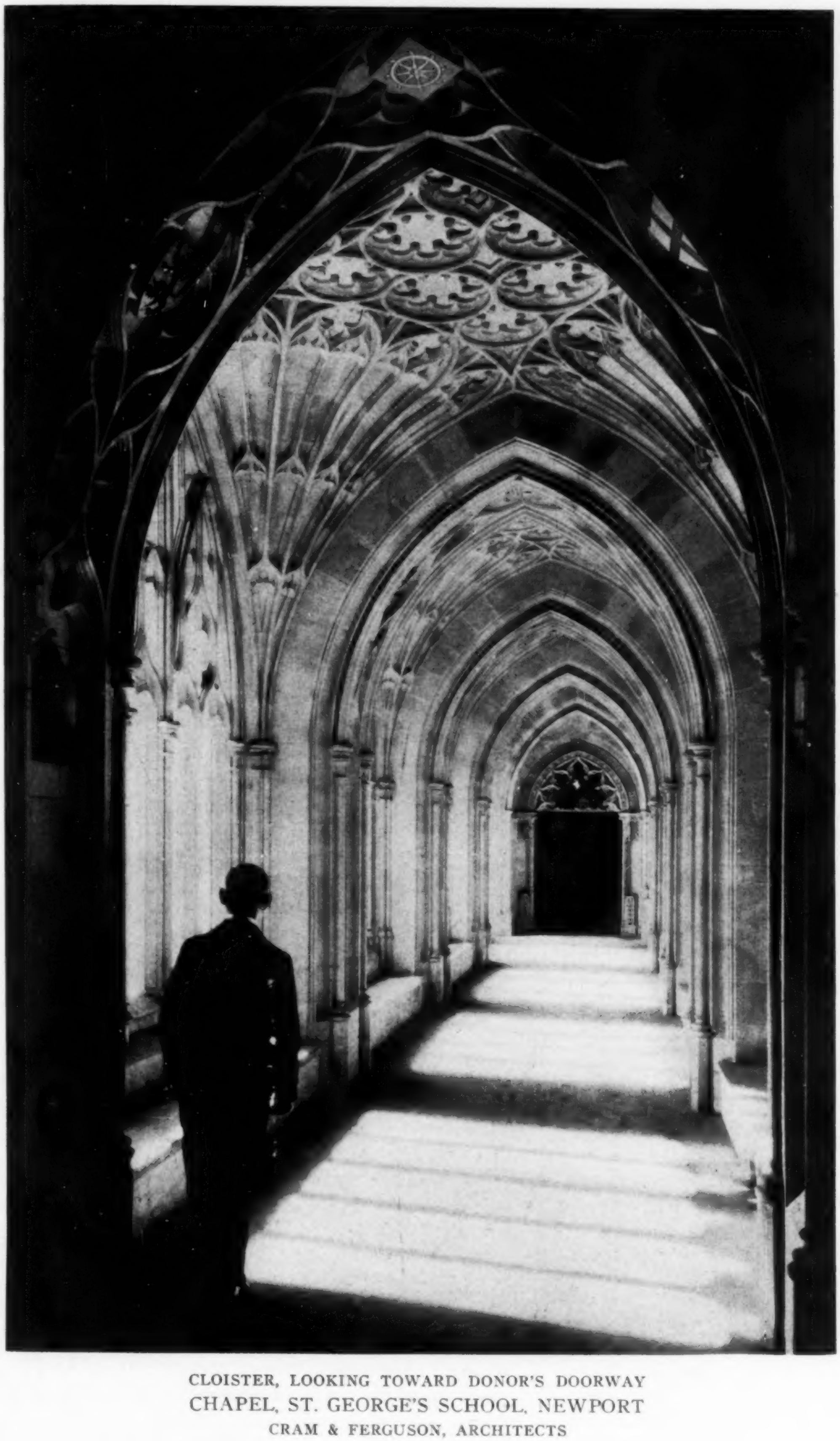


Photos. Sigurd Fischer

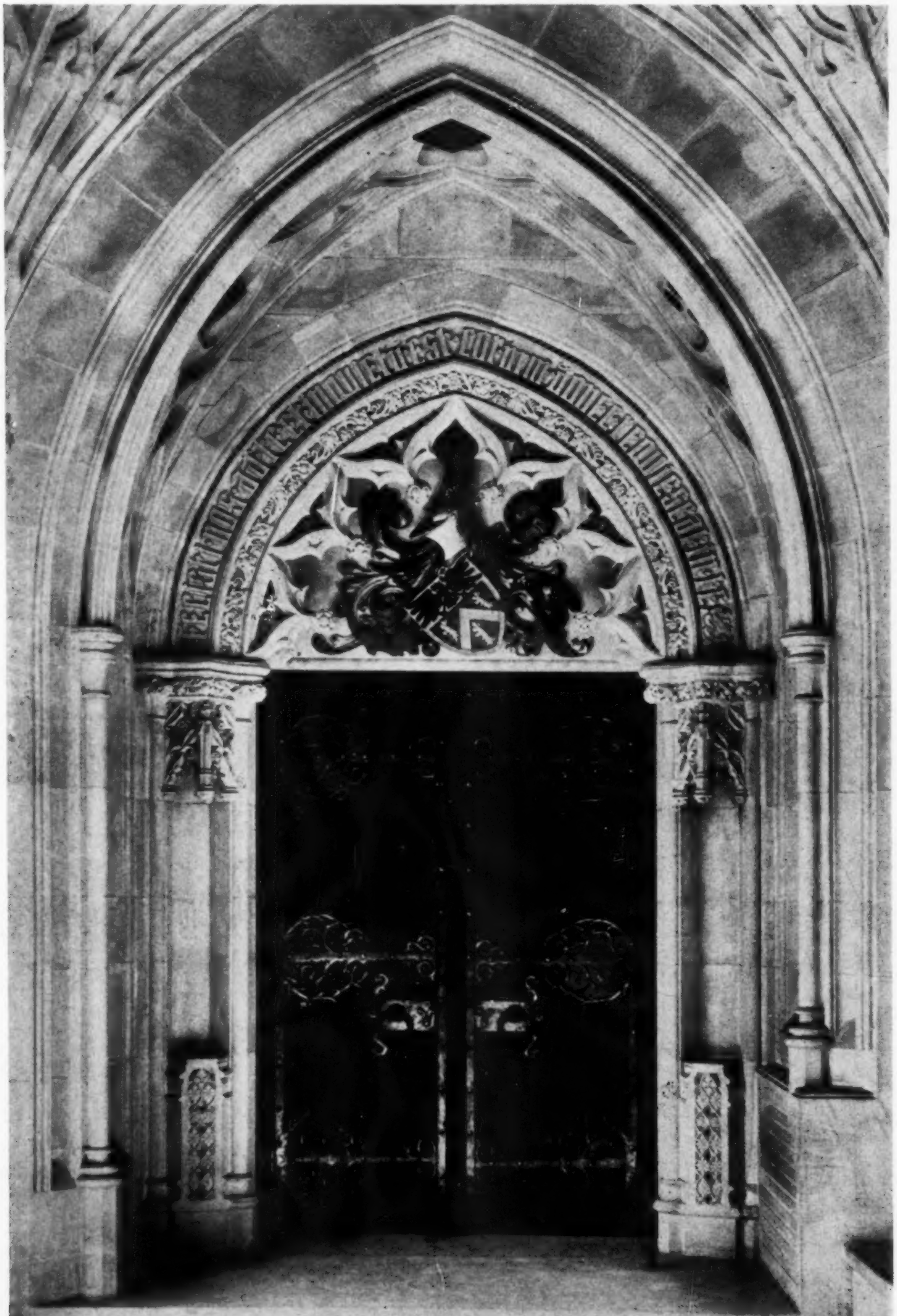
DOOR TO STAIR TURRET WITH FIGURE OF ST. CHRISTOPHER. JOSEPH COLETTI, SCULPTOR

CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT

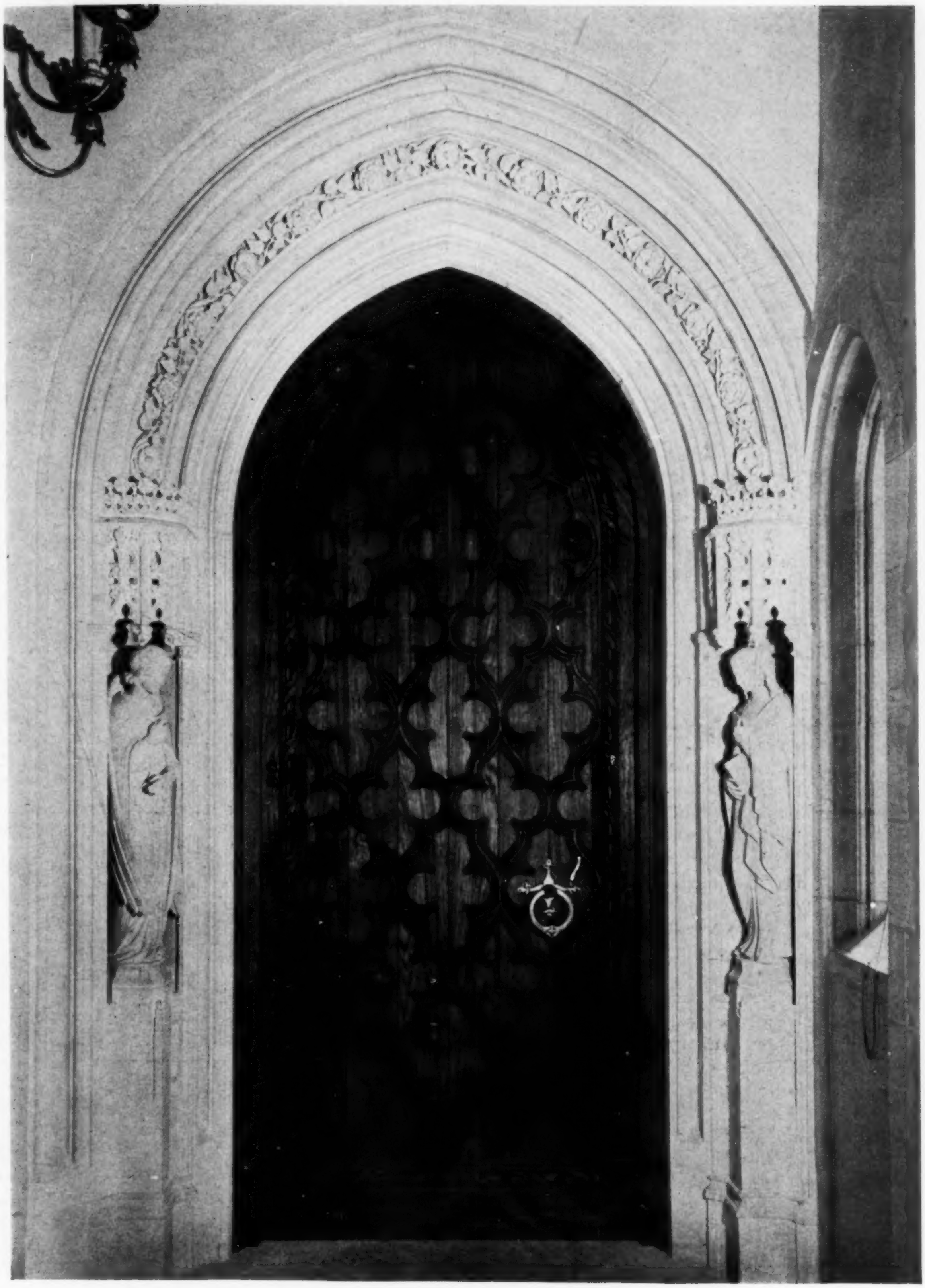
CRAM & FERGUSON, ARCHITECTS



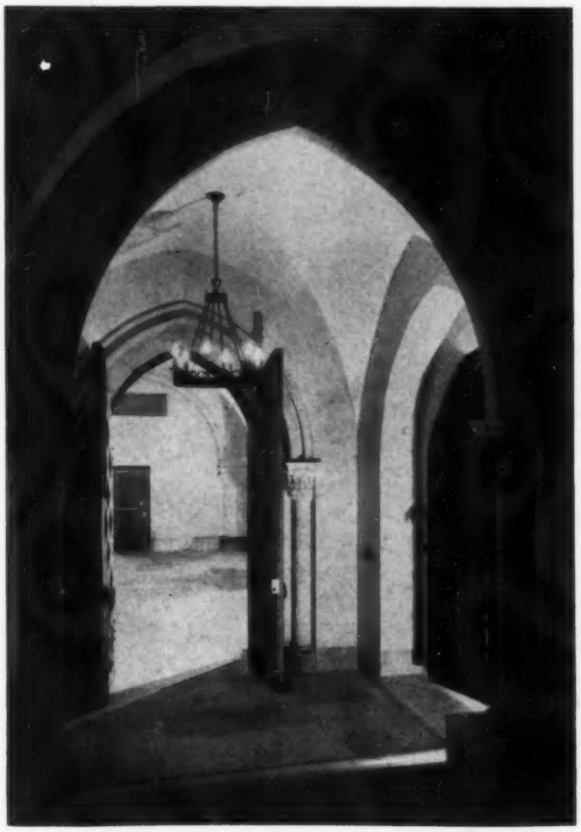
CLOISTER, LOOKING TOWARD DONOR'S DOORWAY
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



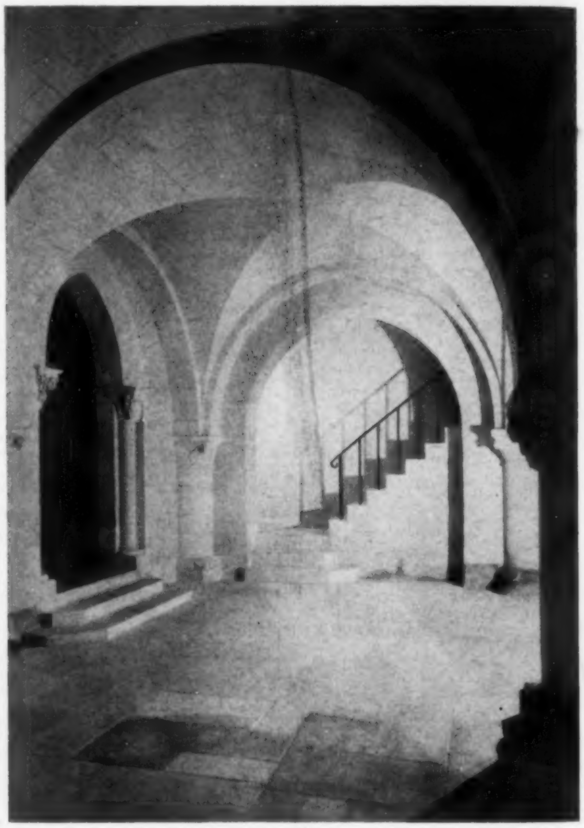
DONOR'S DOORWAY
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



DOORWAY TO LADY CHAPEL
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



Entrance to Crypt



Within the Crypt

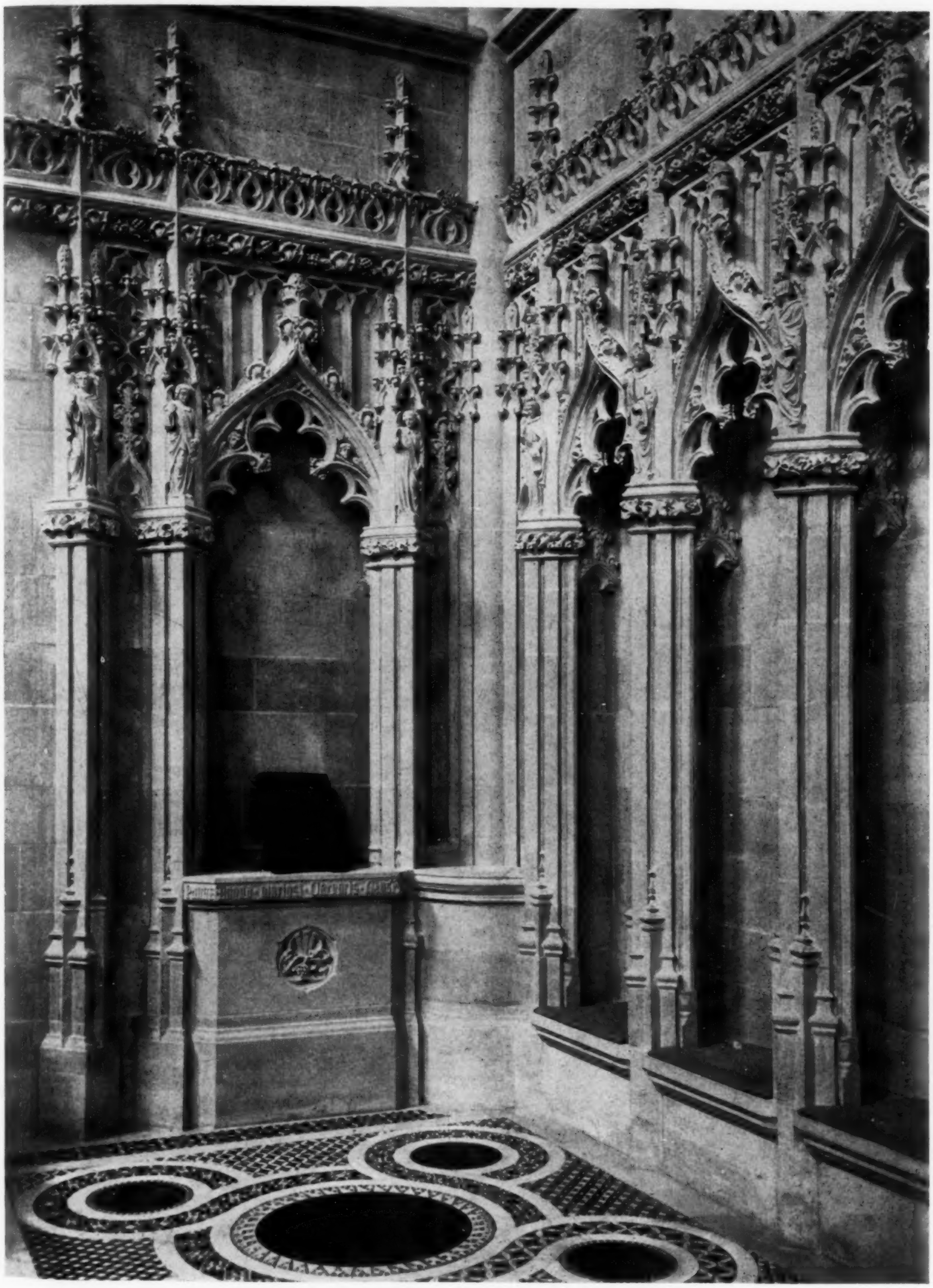
quatrefoil rail, and its slender pinnacles. Two gargoyles project below the rail, and surmounting the whole are two angels symbolizing the fame of architecture,—one is singing and one is trumpeting, and further symbolism is found in their instruments, one of three and one of four trumpets. "Three" is the symbol of the Trinity; "four" is the symbol of the evangelists, and three added to four typify the seven days of creation, while three multiplied by four gives the twelve apostles. On the lintel of the architects' door are the arms of Cram & Ferguson, flanking an inscription.

The remaining iconography on the north elevation is found in the bosses in the cornice moulding. Those on the north transept consist of symbolism of Our Lady,—star of the sea; lily; sun, moon and stars; rose; Queen of Heaven; crown of seven stars, seraphim; sealed book; and star. The cornice bosses along the choir-nave, just above the buttresses (as also on the south elevation), have to do with various historical events, amusements, slang phrases and so forth, popular at the time of building the chapel. Here, for instance, are discernible the crossword puzzle "bug," the "lounge lizard," the solar eclipse of 1925, and various other riddles for future archæologists to puzzle over. Church builders of the middle ages did the same thing, and architects of today miss a special opportunity to humanize their work when they fail to utilize the possibilities of the mediæval grotesque in recording contemporary history, types and mannerisms. The east elevation contains but three figures: Our Lord, in a central niche over the sanctuary window; and in the south pinnacle, St. Stephen, typifying the New Testament,—he was the protomartyr; in the north pinnacle, St. John the Baptist, symbolizing the Old Testament. He was the precursor of Our Lord. The south elevation has the carvings and the heraldry of the cloister, and an interesting symbolization of the four winds, modeled by Andrew Dreselly, as a crowning motif for a small turret at the east corner of the south transept. Virtually all the other sculpture within and without the chapel is the work of Joseph Coletti, of Boston, while Mr. Dreselly modeled most of the architectural ornament.

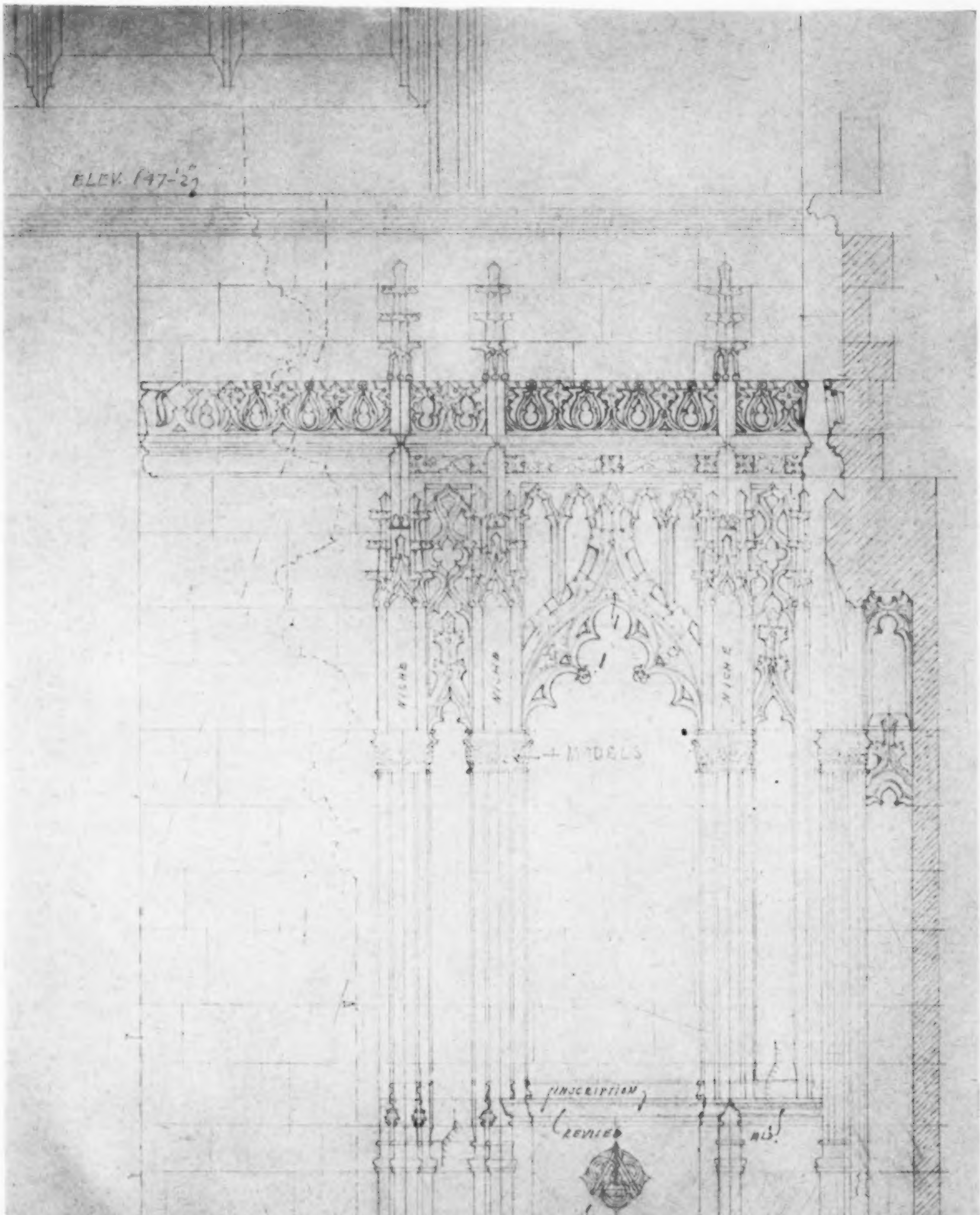
The exterior of the cloister displays the history of shipping in carvings at the junctions of the opening mouldings, beginning with the Santa Maria, and showing the Clermont, the Ann Hope and the Colorado. The cloister is fan-vaulted, with painted symbols of saints in the vaulting. The door at the west end of the cloister gives into the ante-chapel, and is known as the donor's door, the door at the east end gives into the statio, and on

ORGAN CASE
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS

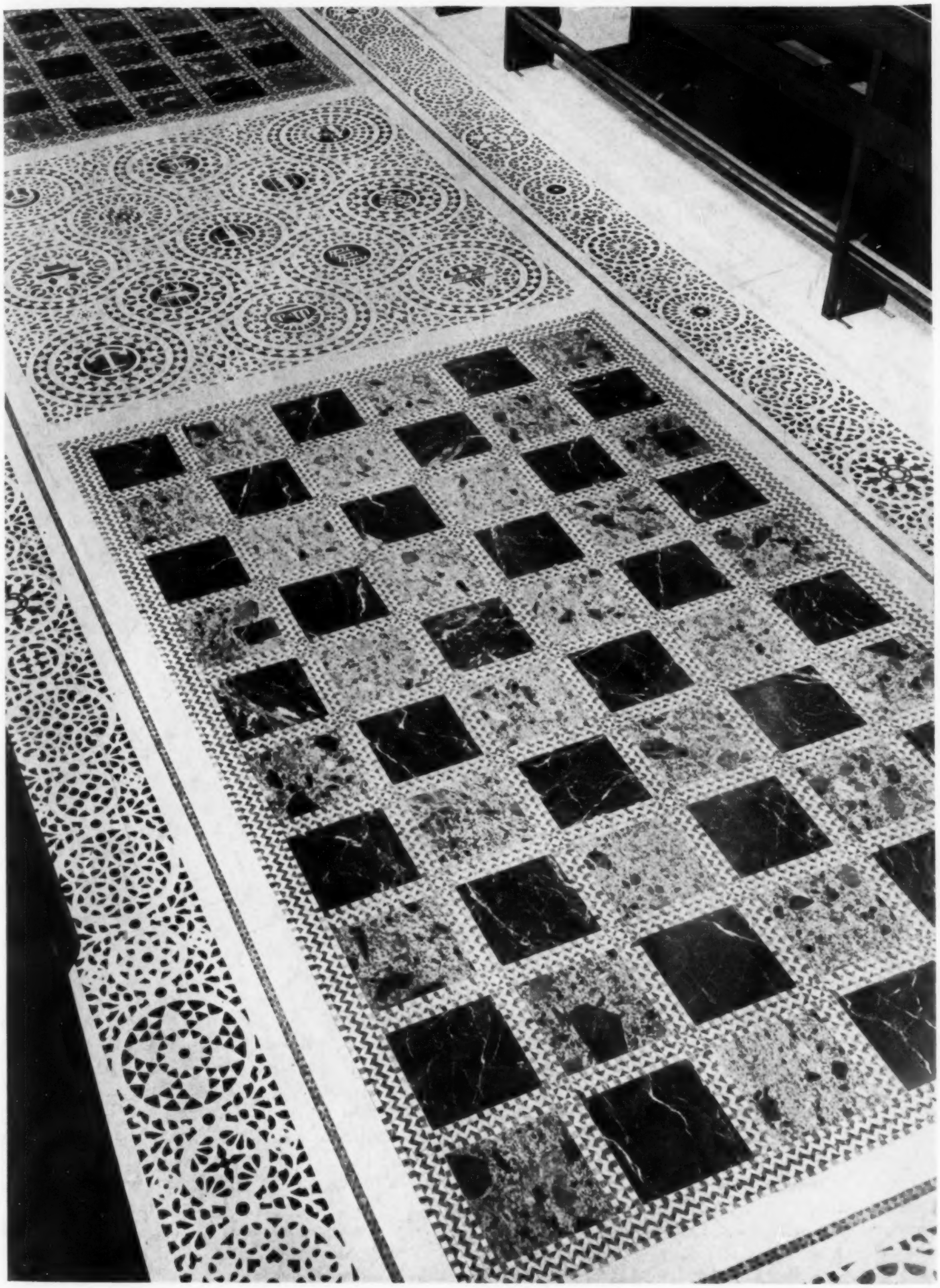
TURRET WITH FIGURES REPRESENTING THE WINDS. ANDREW DRESELLY, SCULPTOR
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



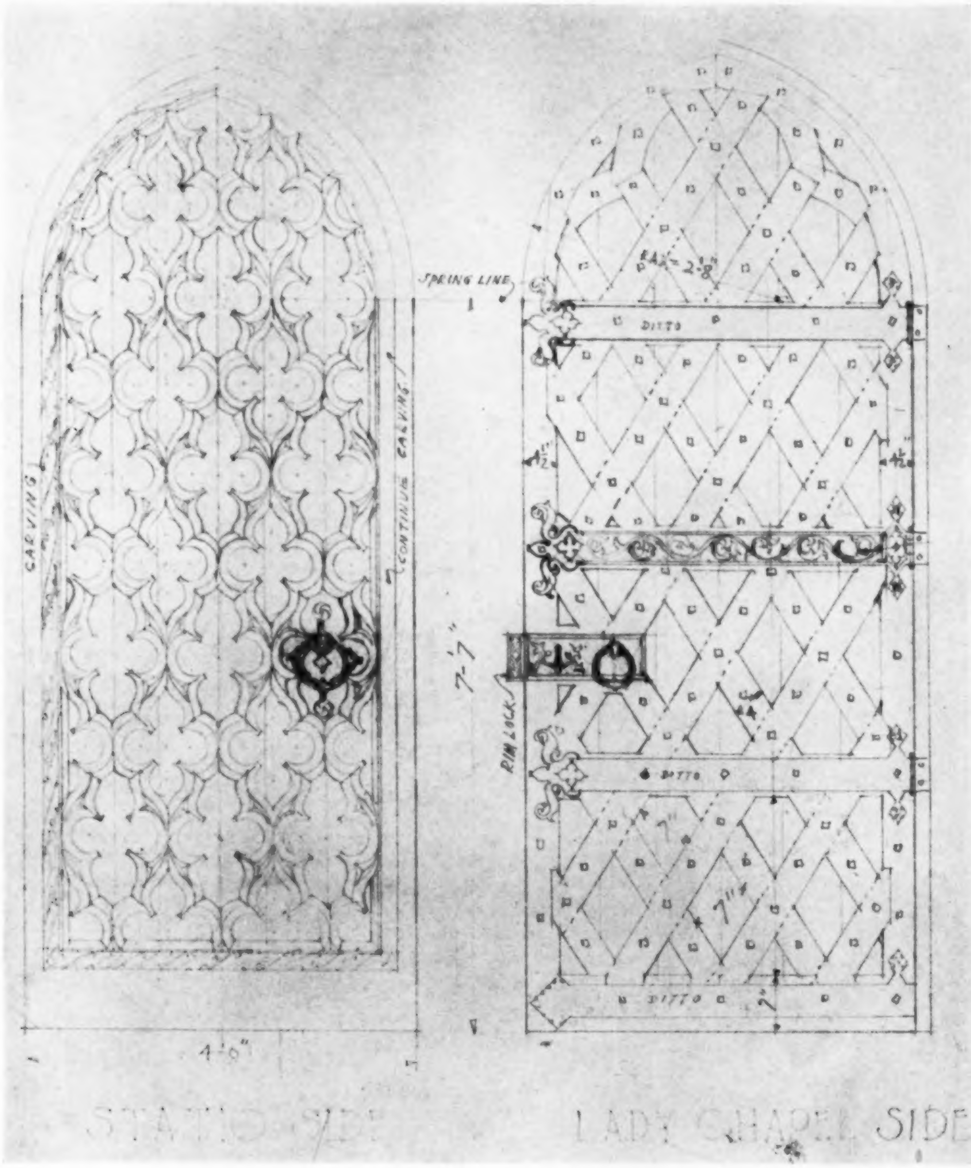
SEDILIA AND CREDENCE,
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



DETAIL, STONE SCREEN, EAST WALL OF SANCTUARY
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS

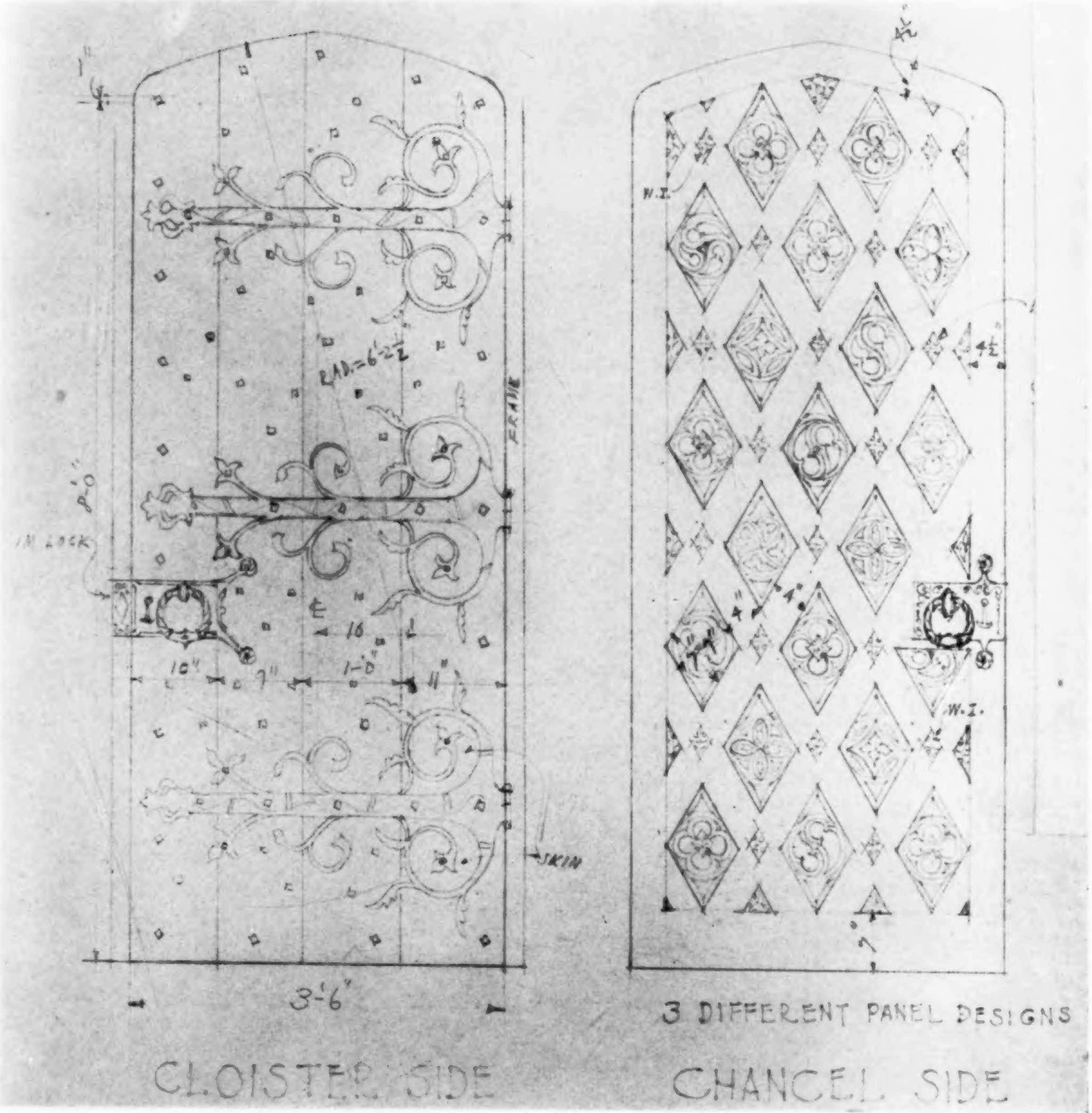


FLOOR BETWEEN CHOIR STALLS
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



Details, Door from Statio to Lady Chapel

either side are figures of the Angel Gabriel and the Virgin of the Annunciation. Similarly placed at left and right of the donor's door are St. John and St. Nicholas, with the family arms of the donor in rich polychrome in the spandrel above the door. Completing the heraldic symbolism at this point, the colored shields and lozenge in the ceiling vaulting at this end of the cloister are those of St. John, St. Natalie and St. Nicholas. The donor's door, made of teak, with splendid hinges and mounts, is intricately carved on the inside,—the doors throughout, indeed, being each an unusually fine piece of design, with wrought ironwork by Samuel Yellin, of Philadelphia. Standing, now, in the ante-chapel, further symbolism offers itself for study. To the left, on entering from the cloister, through the donor's door, there is the south door, above which there is a carved representation of St. George with the dragon, above which, again, are the carved and painted coat of arms of the Bishop of Rhode Island, impaled with the arms of the Diocese of Rhode Island. High aloft, at the intersection of the ribs of the ante-chapel vaulting, is a large boss of St. George slaying the dragon, surrounded by a ring of wingless angels bringing heavenly aid. This is brilliantly painted in red and blue and white and gold, and the vaulting also has four other carved bosses, unpainted. These represent the palms of victory and cross of gold, the peacocks that symbolize immortality, the birds and grapevine, symbolic of St. George's conversion,



Details, Door from Cloister to Chancel

and the fauna that symbolizes creation. The maze in the ante-chapel floor represents the difficulties of the Christian life as encountered in the progress toward the Resurrection as symbolized by the phœnix at the center.

The space now covered by a tapestry on the west wall of the ante-chapel will at some future time contain an open balcony. In the northwest corner is the door to the circular stairway which leads up to the bell deck of the tower,—a doorway not only treated in the Spanish manner of Gothic, but with a painted carving of the arms of Columbus above it. Future historians may find in this a record of Mr. Cram's recent journeyings in Spain, or simply historical symbolization of the land in which the chapel is built. The Spanish motif, however, carries further, for the end of the central core of the circular staircase, at the very top, terminates in a grotesque finial figure of Don Quixote,—symbol of chivalry, if one insists on symbols, but better seen, perhaps, as one of those quaint and enigmatical surprises in which the Gothic buildings of Europe delightfully abound. Above the colored arms of Columbus a figure of St. Christopher stands out from the wall on a corbel. The northeast corner of the ante-chapel will be the baptistry when it is completed, and there will be an elaborate screen separating the ante-chapel from the choir-nave.

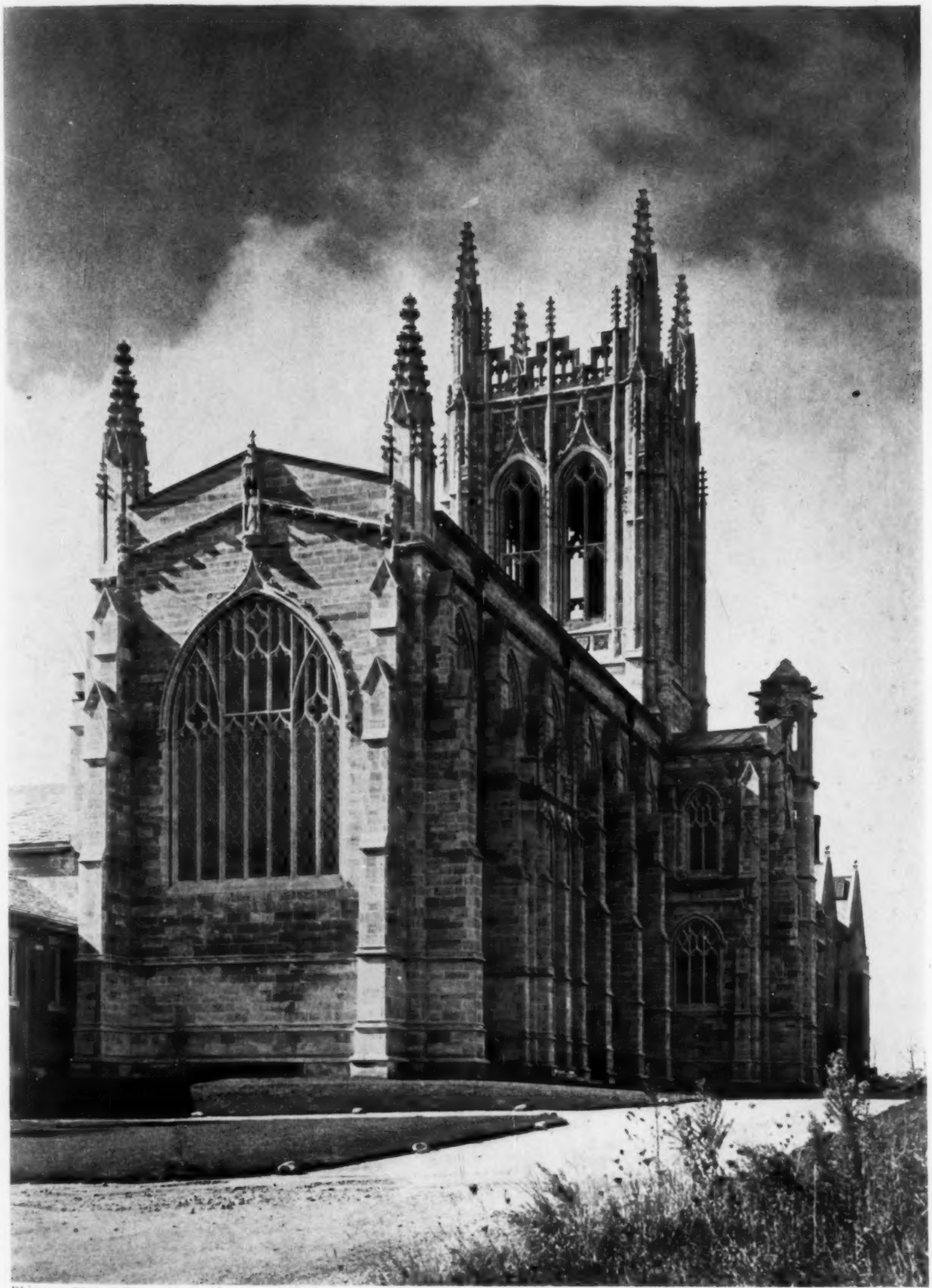
There are stories in the mosaic floor, which is divided into three squares. The first of these (that at the west end) contains nine circles, with

coats of arms of the countries of the Old World whence came the first colonists to the New,—Genoa included, as a tribute to Columbus. There are eight: Ireland, England, Scotland, France, Holland, Spain, Genoa and Prussia, with the arms of the United States at the center. The next square contains the signs of the zodiac, surrounding the sun, with Atlas in each of the four corners. The third square contains 13 circles with the arms of the original states of the union. In the corners of the floor space, at either end of the whole, are animal symbols of the points of the compass: N., a polar bear; E., a moose; S., an armadillo; and W., a buffalo. N.E., a codfish; S.E., an alligator; S.W., a prairie dog; and N.W., an eagle. The floor is laid in marble mosaic, distinctly Romanesque, or even Roman in manner and therefore puzzling to those who see in Gothic only a rigidly stylized articulation of strictly appropriate forms. The truth of the matter is that many a Gothic church in Europe contains work of various subsequent, or earlier periods, and that an *opus Alexandrinum* floor was brought from Rome to Westminster Abbey by Abbot Ware, in the fourteenth century. Thus also with the crystal chandeliers, which seem to some people less appropriate in a Gothic church than some contrivance of wrought iron hoops and massive chains. The architects' eclecticism, however, is supported here by ample precedent throughout France. Specifically, for those who would be specific, the Abbaye aux Hommes,—St. Etienne, at Caen.

As was mentioned in writing of the plan, what would ordinarily be the nave must also, in a school chapel, partake of the nature of what would otherwise be the choir. Fine, simple, rib vaulting carries throughout. In the sanctuary there will eventually be a reredos and altar in keeping with the carved stonework of the walls. The intricate organ screen is rich in its iconography, with four pierced medallions, two at the right and two at the left. These represent the Creation, Nativity, Crucifixion and the Second Coming. The carved wood inverted cresting carries the word "Alleluya" in Hebrew, done in gold characters, and above this are the eight modes of music. The large circular motif in the center above these shows King David, and about him are St. John, St. Cecilia, St. Ambrose, and St. Gregory, Guido d'Arezzo, and Boethius. Above these figures, and below the inscription *Te Aeternum Patrem Omnis Terra Veneratur* are Orpheus, Ptolemy, Pythagoras and Arion with the dolphin. Surmounting the inscription there are small circles in which appear the swan, Euterpe, Polyhymnia and the nightingale, at the left and the right of a central motif of Apollo. This lower cresting is set off from the portion above by four carved finials of the archangels, Uriel, Gabriel, Michael and Raphael. Above these, and to the left, is an angel blowing a trumpet; to the right is an angel playing a stringed instrument, and surmounting the whole intricate composition the inscription *Te Deum Laudamus Te Dominum Confitemur* in the uppermost cresting. Certainly a piece of work in which design and craftsmanship combine to effect a thing unusually fine. At the right of the sanctuary a door opens into the statio, which gives access to the lady chapel (the old school chapel), to the sacristy, to the door from the east end of the cloister, and to the stairs to the crypt.

Some of the most interesting carving in the chapel is found here, in column capitals suggesting Romanesque as much as Gothic. The outer columns at the sides of the crypt door show symbols of the Incarnation,—Shadrach, Meshach and Abednego in the fiery furnace, and Daniel in the lion's den. Here, also, the story from the Apocrypha, in which the angel grasps the prophet Habakkuk by the hair of his head. The inner column capitals by the entrance door have to do with symbols of the Resurrection, showing Jonah and the whale, and Jonah entering the city of Nineveh. From mediæval mythology there is the symbol of the lion and cub, in which a male lion breathes life into the cub three days after it has been born dead. Last of all, there is the capital of the central column in the crypt, showing the four rivers of paradise,—Gihon, Tigris, Euphrates and Pison. The thought here is that these four rivers foreshadow the four evangelists, who poured forth, like rivers, their inspiration to the world. At the four corners are fruits of paradise. St. Matthew, associated with the river Gihon, wrote for the Hebrews, hence the Hebrew inscription for the river; St. Mark, with the river Tigris, wrote for Greeks, hence the Greek inscription; and St. John, with the river Pison, was the herald of all.

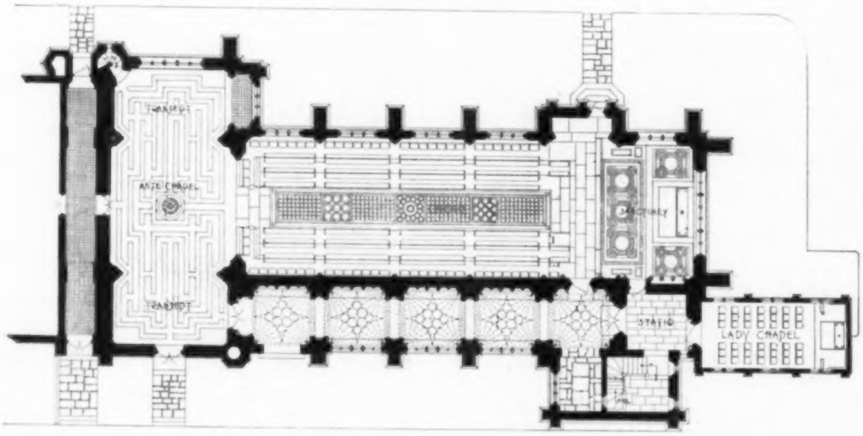
Three years in the building, and dedicated April 23, 1928, we see this beautifully designed and carefully articulated chapel building in all its newness, even yet not complete, and not yet with any of that charm that the patine of age lays with gentle hands upon even the least consequential building of antiquity. Yet, for all this, we see a highly and finely finished work. The St. George's School Chapel is distinguished architecture, which cannot be said of too long a list of recent buildings in this country, or, for that matter, in Europe. Although we do not in too many instances seem to regard them, we have architectural standards in this country. This firm, past and present, is one of the associations of architects which has done its share in establishing and maintaining through several decades these standards by work as definitely stylized, and at the same time as definitely personal as St. George's School Chapel.



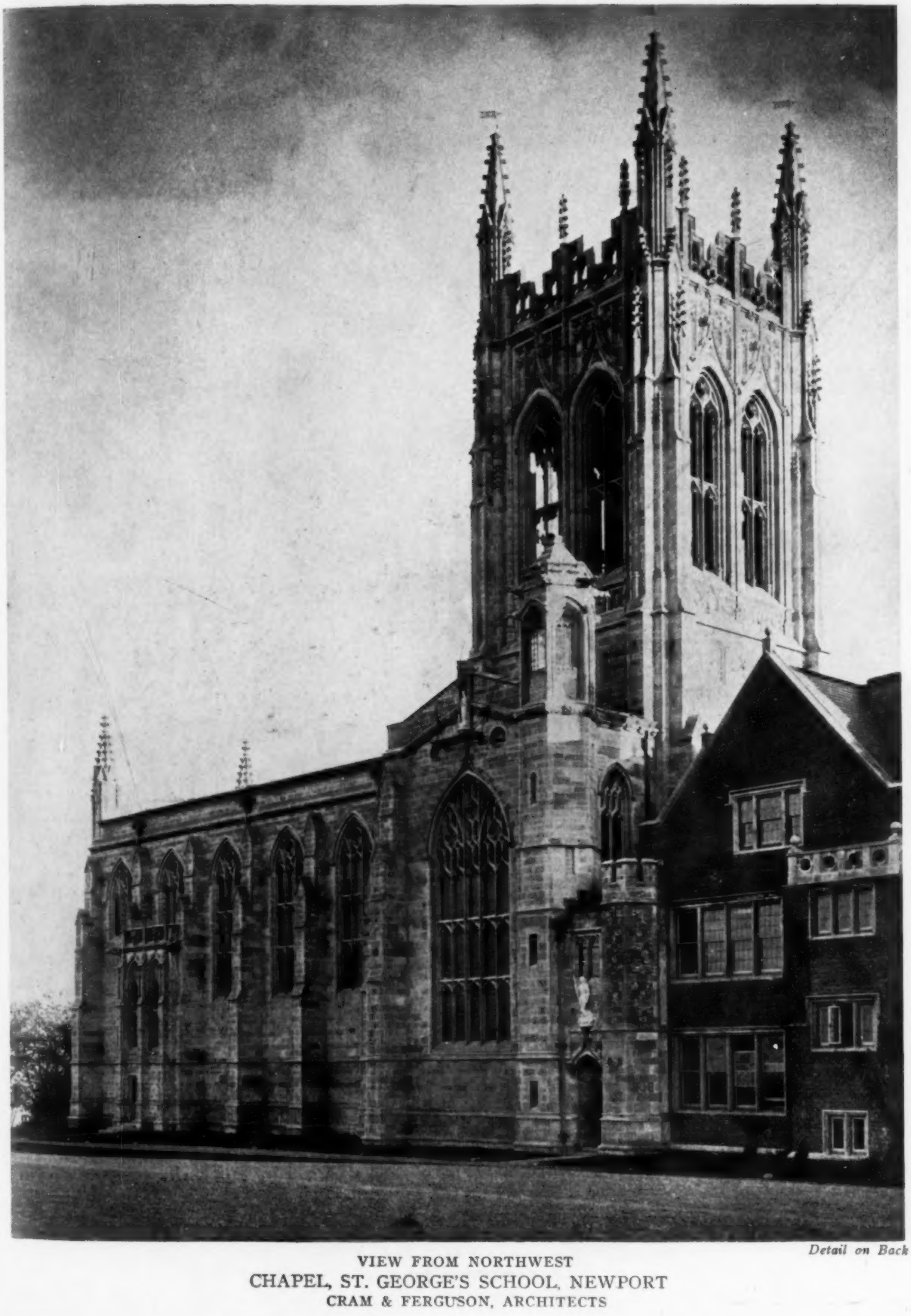
Photos, Sigurd Fischer

Plan on Back

CHAPEL, ST. GEORGE'S SCHOOL NEWPORT
CRAM & FERGUSON, ARCHITECTS

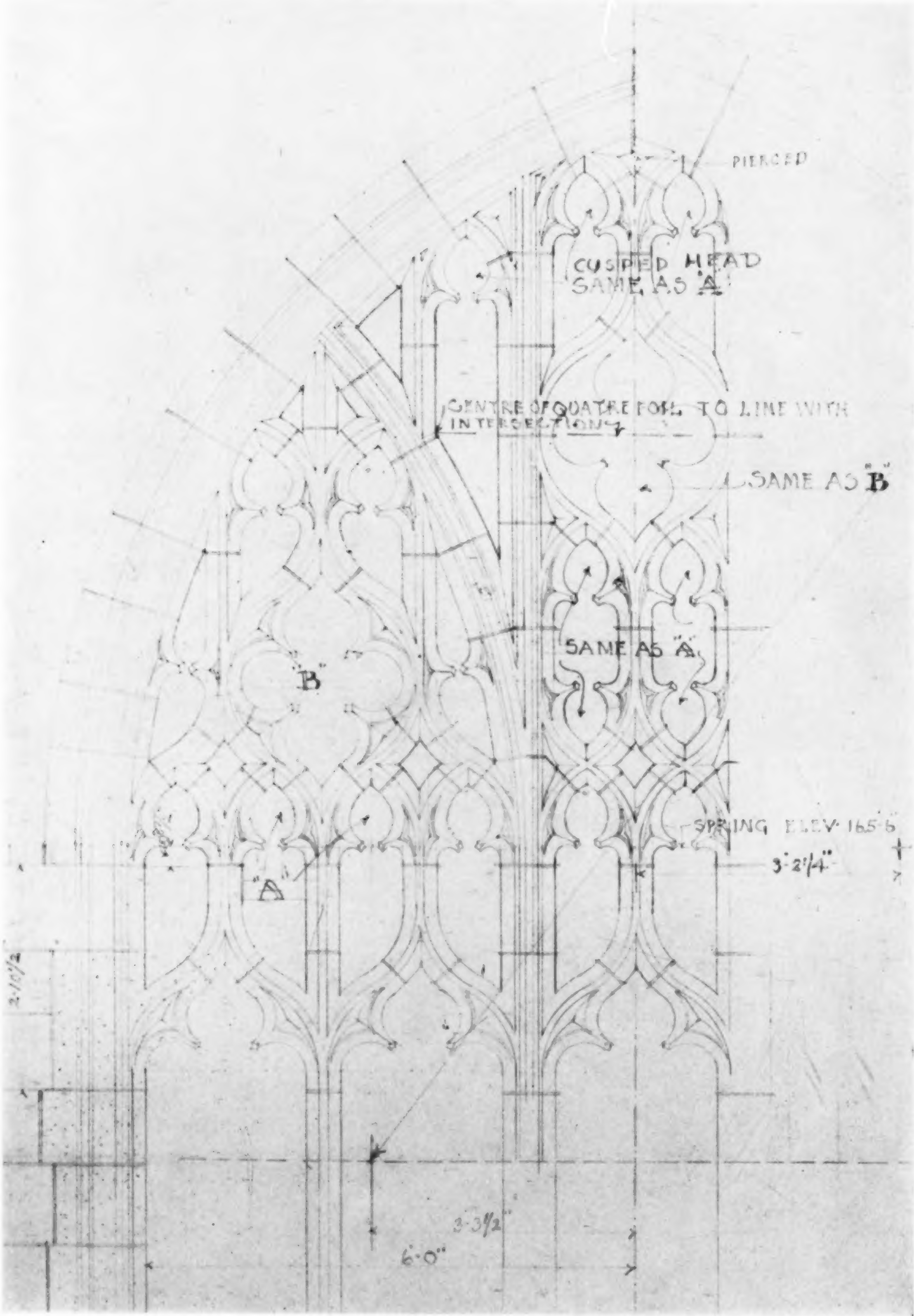


PLAN. CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS

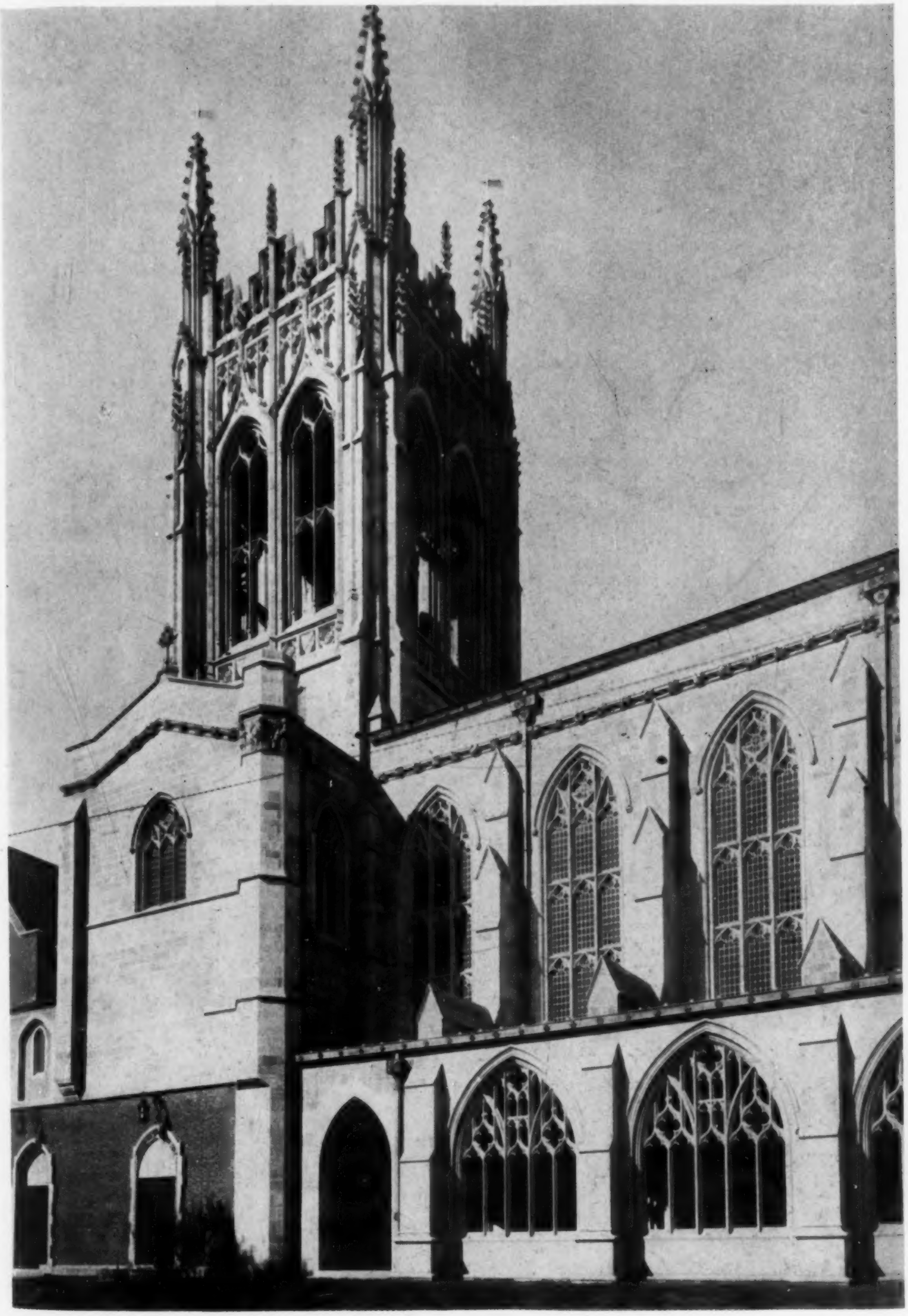


Detail on Back

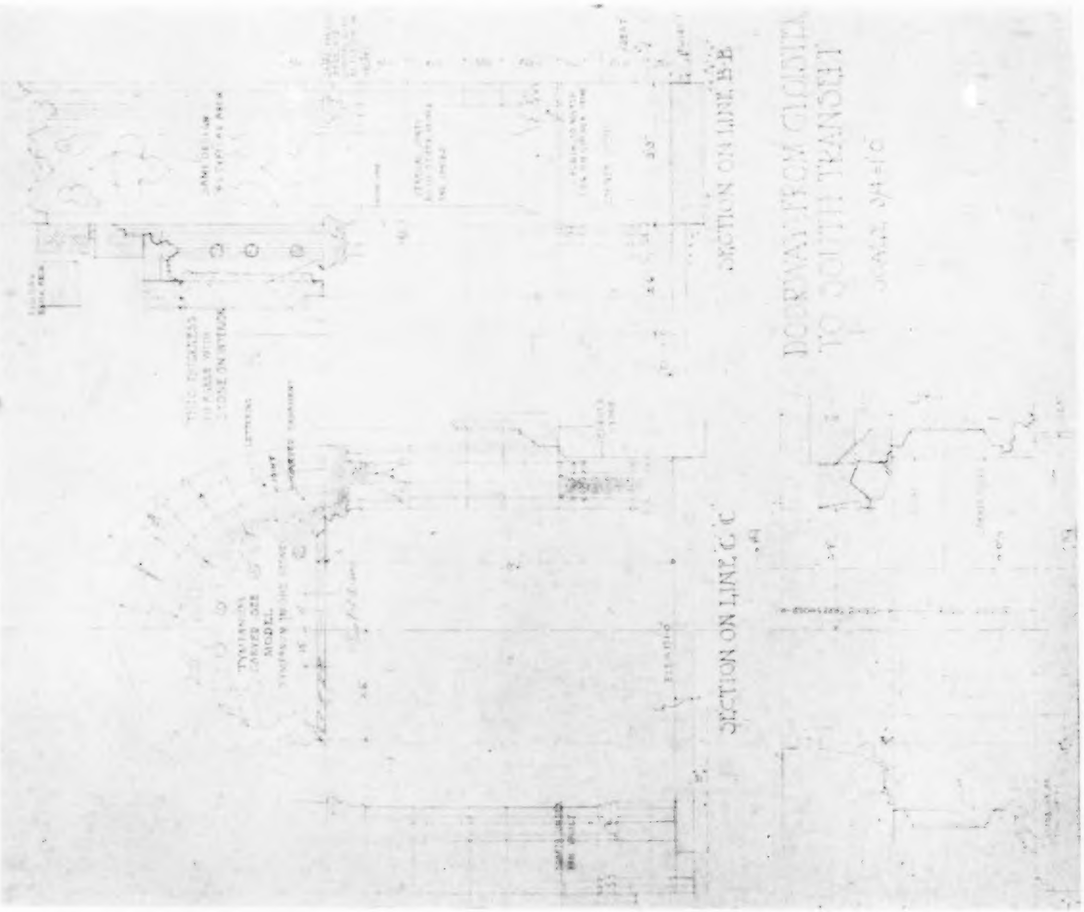
VIEW FROM NORTHWEST
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



DETAIL, UPPER PART OF NORTH TRANSEPT WINDOW
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



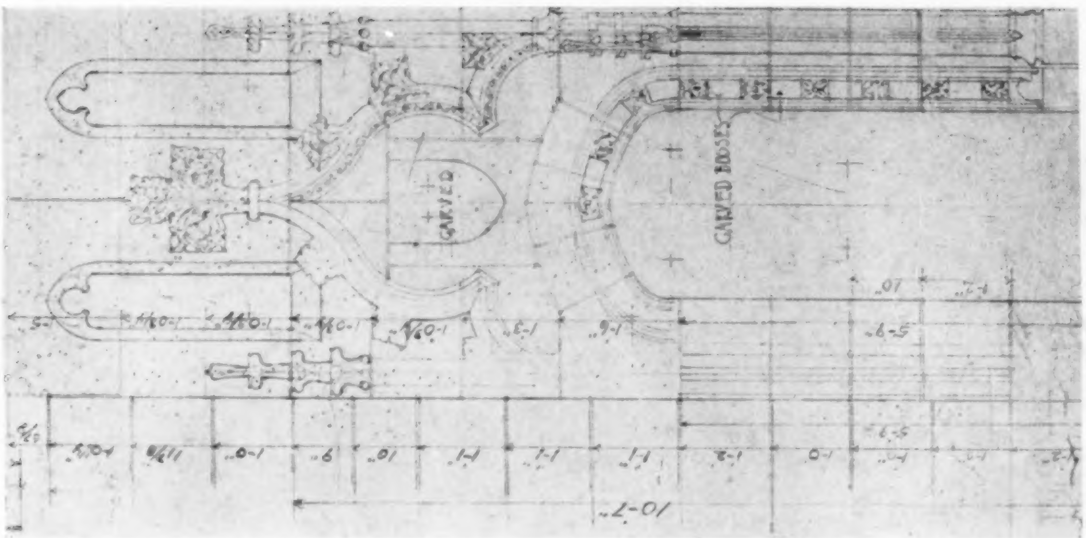
TOWER, SOUTH TRANSEPT AND CLOISTER FROM SOUTHEAST
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



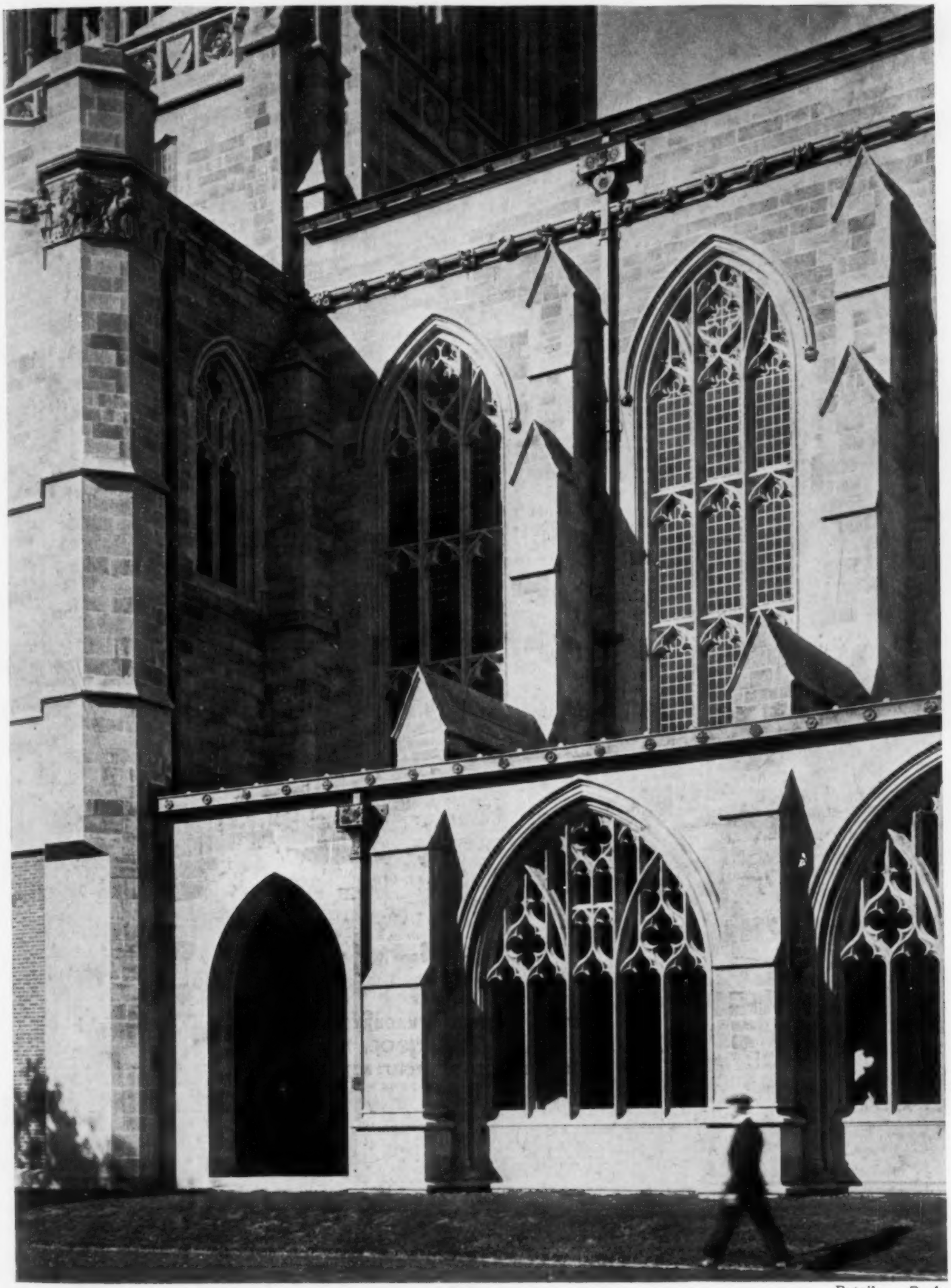
DETAIL, DONOR'S DOORWAY

CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT

CRAM & FERGUSON, ARCHITECTS

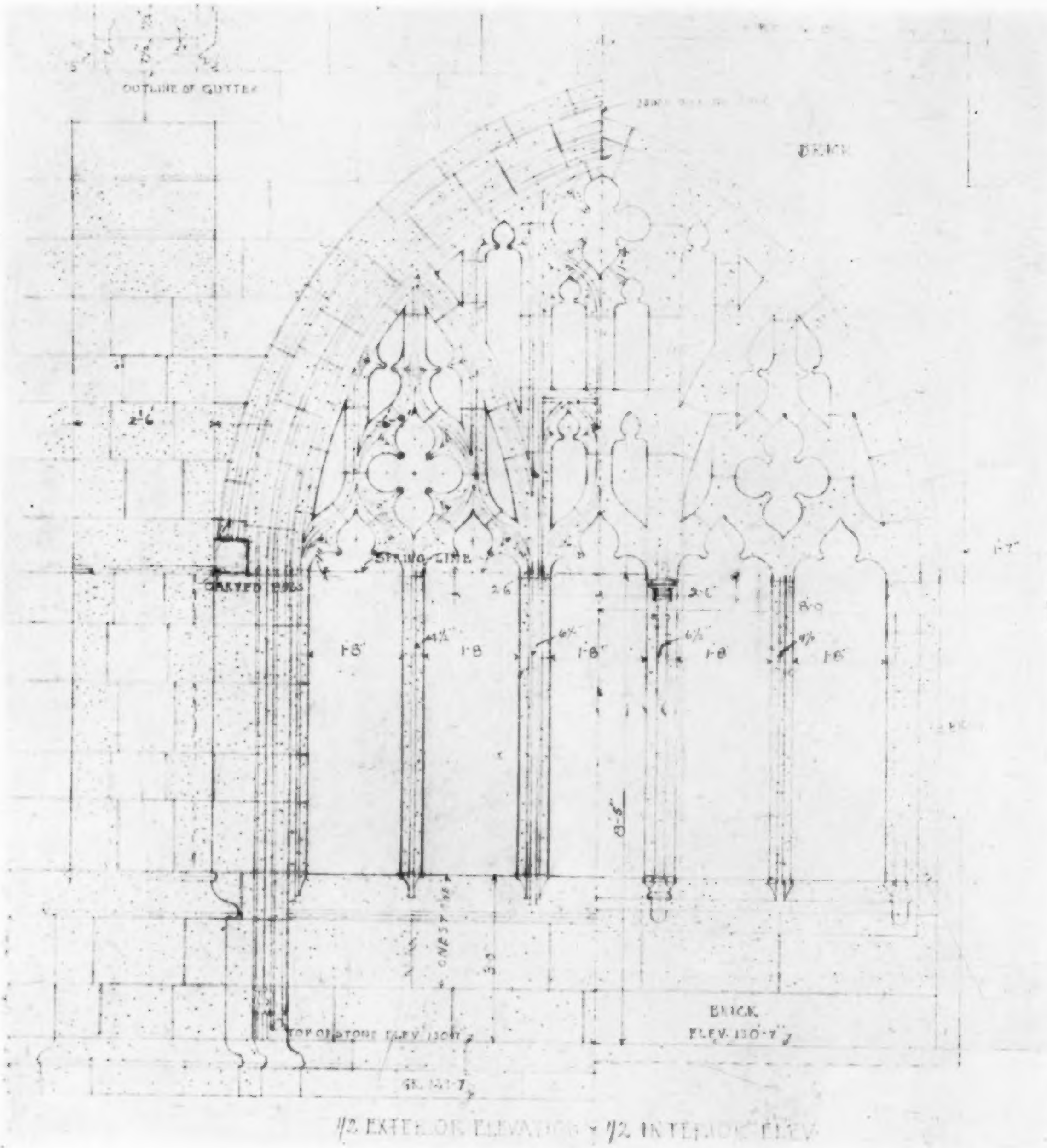


DETAIL OF A DOORWAY

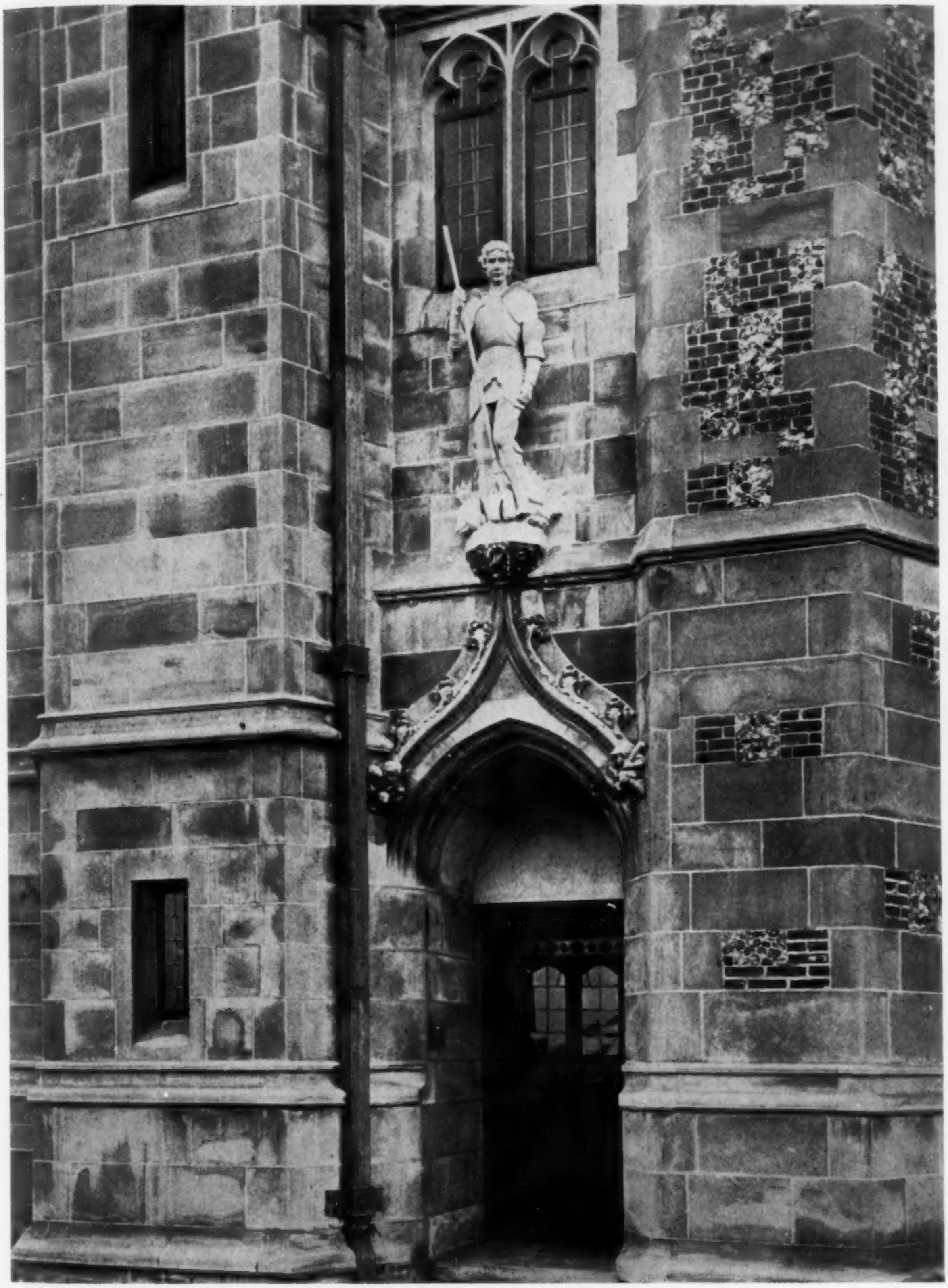


Detail on Back

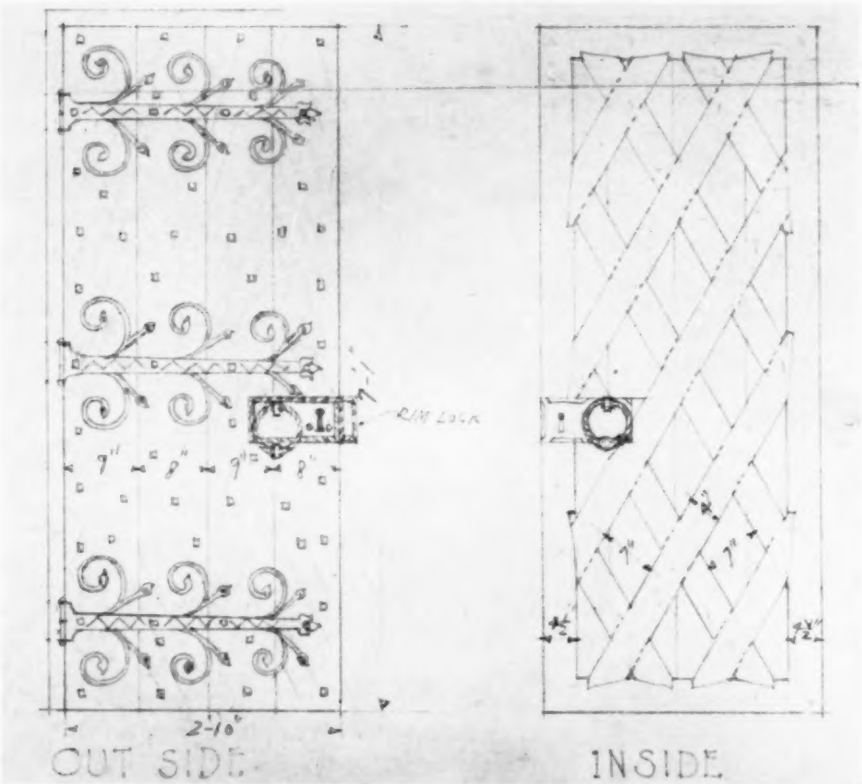
CLOISTER
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



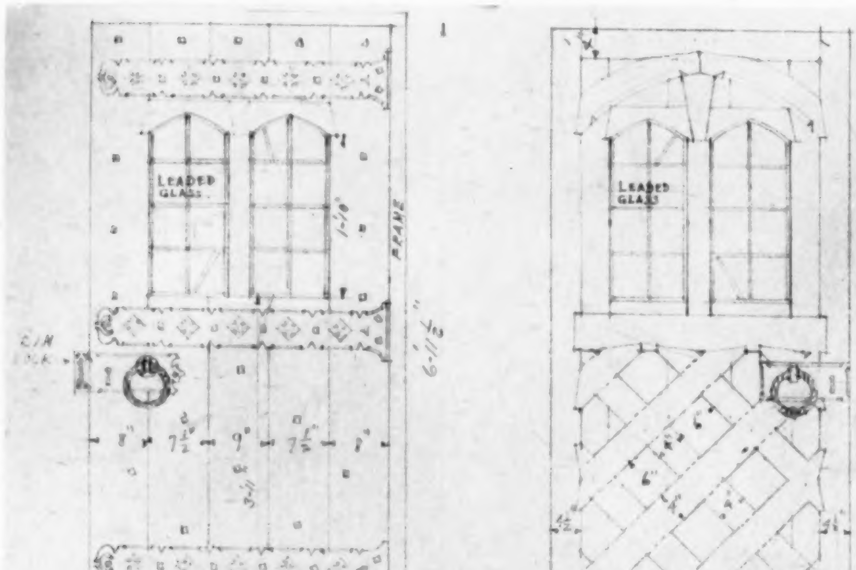
DETAIL, CLOISTER TRACERY
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



ST. GEORGE'S DOORWAY, FIGURE OF ST. GEORGE BY JOSEPH COLETTI, SCULPTOR
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



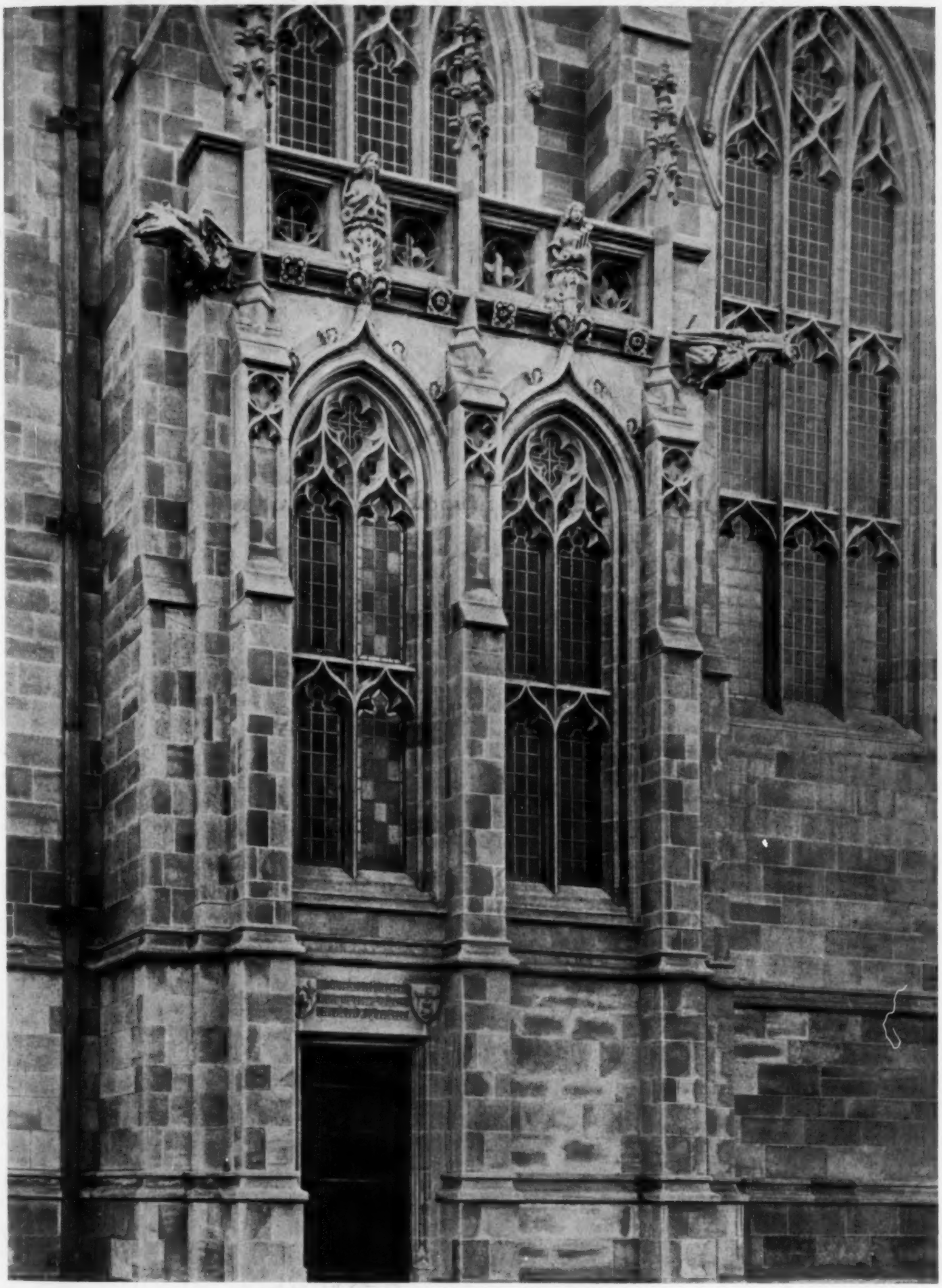
DETAIL, DOOR IN CONSOLE BAY



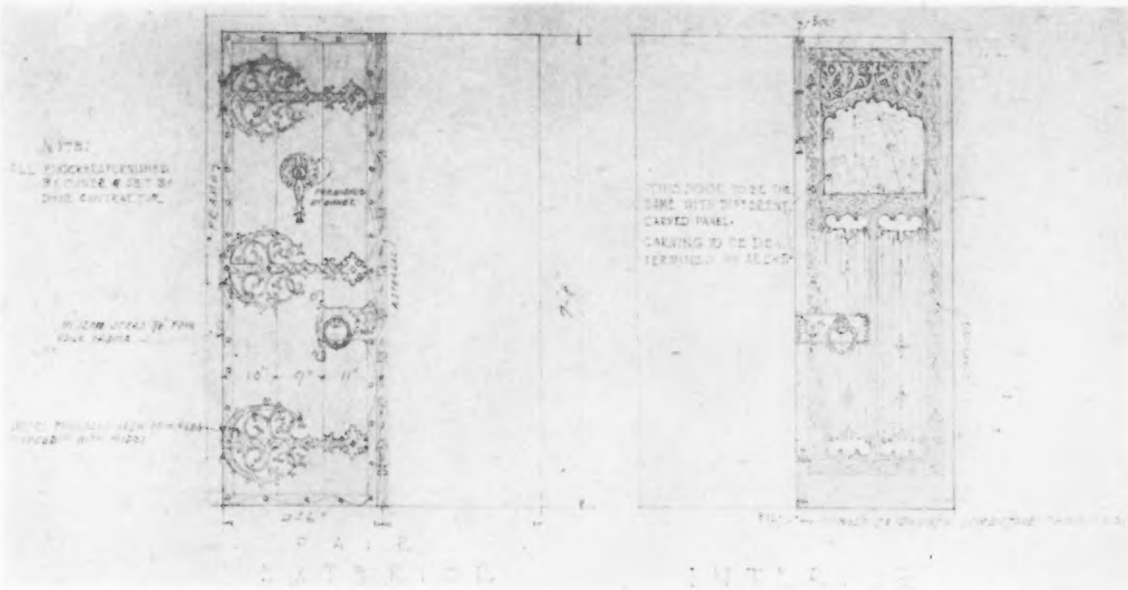
DETAIL, NORTH DOOR TO PASSAGE

CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT

CRAM & FERGUSON, ARCHITECTS



BAY ON NORTH SIDE, AND ARCHITECTS' DOORWAY
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



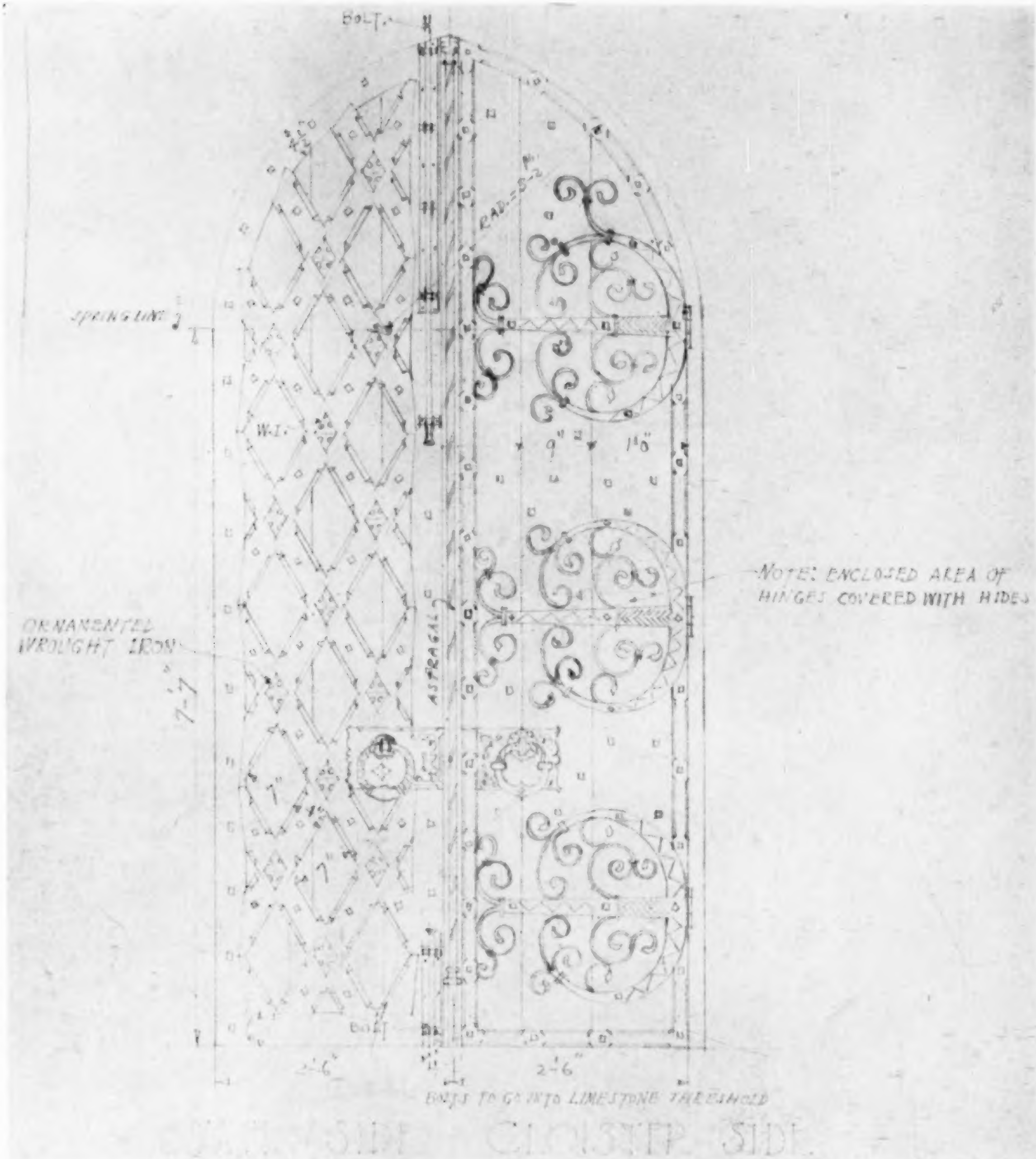
DETAIL, DONOR'S DOOR FROM CLOISTER TO TRANSEPT

DETAIL, DOOR FROM ANTE CHAPEL TO PASSAGE

CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT

CRAM & FERGUSON, ARCHITECTS

SANCTUARY
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS



DETAIL, DOOR FROM CLOISTER TO STATIO

CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT

CRAM & FERGUSON, ARCHITECTS

INTERIOR, LOOKING WEST
CHAPEL, ST. GEORGE'S SCHOOL, NEWPORT
CRAM & FERGUSON, ARCHITECTS

THE RELIEFS AND GRILLES OF THE CHANIN BUILDING VESTIBULES

BY

RAYNE ADAMS

IN writing about the reliefs and grilles which decorate the vestibules of the Chanin Building in New York, one has a vague feeling that it may be necessary, quite at the outset, to take the offensive and establish, by way of bastions and barricades, some generalizations which will forestall to some extent the criticism to which these decorations will be subjected. Yet this need be an offensive of only the most gentle and retiring variety. It will have in it somewhat of the inviting arrogance, I trust, which clothes the aggressiveness of Montaigne's preface in which he informs the reader, with much placidity, that if he doesn't like the book, he need not read it.

Most designs are conceived and executed with little thought. This may be regarded as a statement sufficiently broad to set the judicious grieving. Be that as it may, I think it no looser than many another generalization which, though a fiction, is useful. It would seem that the common run of decorative design,—in all the many arts,—follows along no intellectual line of effort which is in any way exacting. Most of us choose the easiest path. If we have to portray winter, we picture it as "a weak old king who feels, like Lear, upon his withered face, Cordelia's tears." And all select a bluebird as a symbol for happiness. The æsthetic dreams of the world are built into the common clay of actuality by the use of a thousand thousand accepted conventions. When Arnold de Villeneuve discovered the book of the great Geber which was to bring him the secret of wealth and the secret of youth, he found the quest symbolized in two pictures and described thus:—"The first represented a flower with a blue stalk, red and white blossoms, and leaves of pure gold, which stood upon a mountain top, and was bent by a gust of wind which blew from a blood-red cloud. Around the flower was a circle of open eyes. Above the circle was a naked hand holding a sword transversely by the blade. Below was a heart transfixed by what appeared to be a long pointed nail or spike. The picture upon the last page of the book represented a king with a golden sword in the act of killing a naked child, and a beautiful winged figure catching the blood in a crystal vase." . . . And so on.

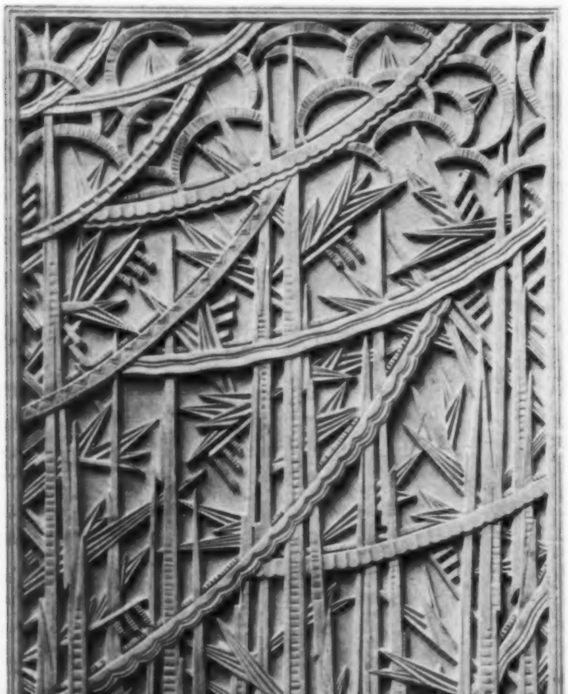
Of course it is charming; the fact that it has to do with the poignant story of Arnold gives the symbolism an emotional content. Yet even at its best, such symbolism bears with it the seeds of its own death; it sets up a convention the arbitrariness of which is only too apparent. It has too often a certain gross quality; it lacks subtlety, and it is frequently labored. Yet,—and here is the crux,—the all-important question to be asked is this: is the picture, in the old fashioned words, good looking? Does it please the æsthetic sense? If it does, we may justifiably close our eyes to the labored symbolism and go on our way with the sure conviction that we have in some manner, through emotional stress, even for one brief instant, been born again. And this symbolism,—what is it but a kind of alphabet, or more properly, a language? It is of course a language which we all know. But if the goal of art be Roman,—there are other roads to Rome.

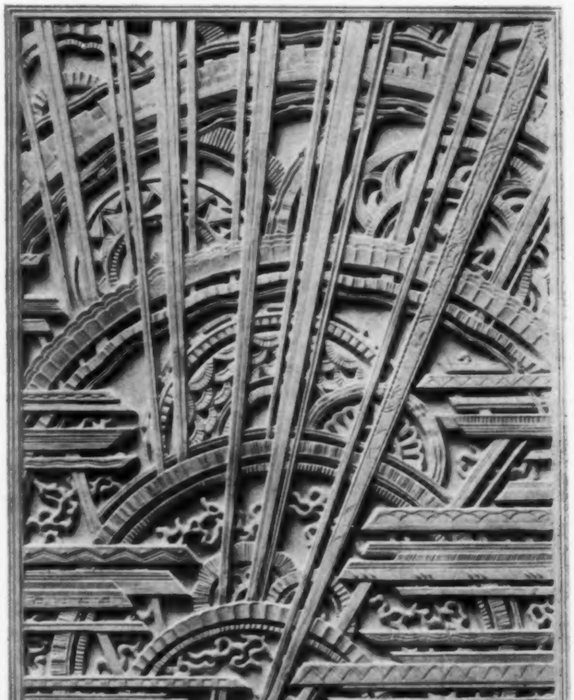
Many years ago, in a strange book by George Winslow Pierce, I came across these lines, and they brought me sharply to the realization of the possibilities of a symbolism which, though belonging to geometry, is of the essence of poetry:

"My design on the cover, with its regular lines and heart-like curves, symbolizes the flower of Love and Truth. The fruit developed at the center is a star, which is the emblem of Unchange."

What Pierce did was to make geometry ideographic. And is our common alphabet more than a miracle of ideographic symbols transmuted into phonetic signs? Yet out of the alphabet and the languages which rise from it are built the appealing dreams of much of our emotional life. Hamlet is a creature of the alphabet. And if one make one alphabet,—why not another? And if the concatenation of events be conformable, as M. Aurelius would have said, to the ends for which Nature destined it, we may have what is commonly called a work of art. At any rate, the effort to achieve such a construction would seem to be worth while. Naturally, no such alphabet,—no such symbolism,—can be complete, and the more inelastic, the more recalcitrant the form of the art, the less subtle, the less satisfactory will be the symbolism. Nevertheless, in constructing a symbolic alphabet we give rein to our fancy, and as we develop the ideas based upon it, we have the assurance that there are, metaphorically, definite hooks on which to hang our hats. Good or bad, it will have a meaning,—if only for its inventor. The system of symbolism given, the final and momentous question remains: will it lead to an æsthetic result which will stir us? That however is, as the Greeks would have held, in the hands of the Fates.

The Chanin Building's vestibule reliefs and grilles, designed and modeled by Rene Chambellan in collaboration with Jacques Delamarre of the



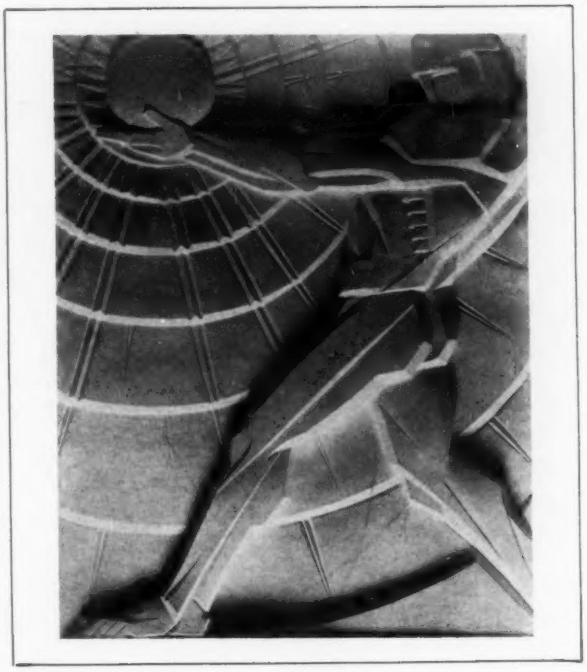


Photos. Louis H. Dreyer

AGITATION VISION

RELIEFS AND GRILLES, CHANIN BUILDING, NEW YORK

RENE CHAMBELLAN, DESIGNER. JACQUES DELAMARRE, COLLABORATOR



COURAGE

ACHIEVEMENT

RELIEFS AND GRILLES, CHANIN BUILDING, NEW YORK
RENE CHAMBELLAN, DESIGNER. JACQUES DELAMARRE, COLLABORATOR

ACTIVITY

EFFORT

RELIEFS AND GRILLES, CHANIN BUILDING, NEW YORK

RENE CHAMBELLAN, DESIGNER. JACQUES DELAMARRE, COLLABORATOR

ENDURANCE SUCCESS

RELIEFS AND GRILLES, CHANIN BUILDING, NEW YORK

RENE CHAMBELLAN, DESIGNER. JACQUES DELAMARRE, COLLABORATOR

architectural staff of the Chanin Company, are an open expression of this attempt. The dominant idea which they have sought to set forth is the significance of geometric lines and their capacity to symbolize emotions and abstractions of thought and deed. God forbid, as the phrase goes, that I should here attempt to expand upon the psychology of geometric symbolism in the arts. Nevertheless, one may lamely point out that a consensus of opinion (whatever it may be worth) has established certain characteristics which are associated with types of line and of form. For vexation or perplexity we all scribble a confused scrawl; the flowing curve suggests ease and grace; the circle suggest completeness;—and so on until we come to those geometric lines and forms which have as yet not been so endowed with definite significance of this sort. Yet there is no reason why we should not make such endowment, and thus, armed with a quiver of symbols, build our geometric romance.

For those who have stood before the Chanin vestibule's grilles and wondered, saying, some demurely and others not, "What is this all about, and why?", it is not sufficient to answer them in their own manner and ask them, with Voltaire, "Why is there anything?" The *raison d'être* of these grilles is drawn from the life of a man who, in his chosen field, has achieved much,—and the aspects of his struggle and success have given Chambellan and Delamarre a theme which they have chosen to set forth forth in geometric symbols. In these reliefs and grilles they have envisaged this life under two commonly accepted categories,—that which sets forth the physical life and that which sets forth the mental life. This distinction, as every psychologist knows, is purely logical and artificial. That, of course, is granted; it is a convention, and it is artificial, just as all art depending on conventions is artificial. This distinction being granted, certain phases of development under each category are presented by a panel figure in relief supplemented by a grille design placed immediately beneath. In brief summary, that series which represents the mental development shows these various groups: (1) *Agitation.* This portrays the first conscious stirrings; the first doubts, the first questions and uncertainties. (2) *Vision.* We see here the representation of the birth of conscious planning and the formation of a definite and compelling ideal. (3) *Courage.* This shows the man at work,—following out, with firm resolution and steady purpose, those ideals which are his, beset by obstructions, yet achieving. (4) *Achievement.* Here we see the fulfillment of his work. The physical series, which contains the groups named,—Activity, Effort and Endurance, and Success,—exemplifies in its way the characteristics presented by the series showing the mental development. Of course, such a presentation of the life romance of an individual can hardly hope to be inclusive of all the factors. Chambellan and Delamarre have elected to use, as it were, a palette of high colors in developing their thought. The treatment of the panels can hardly be universal; it applies only to a certain type of man who has seen clearly and acted energetically. The symbolism would have to be expanded to give us a sense of "the blue and the dim and the dark cloths, of night and light and the half light."

The supplementary grille panels, wholly geometric in conception, present a symbolism which, interpreted, bears out the meaning of the corresponding relief figures. I have chosen the relief called *Vision* and its supplementing grille design, to set forth as a typical example of the symbolism which runs through all the work. In the relief, showing a crouching figure, we see the vacant look,—"the light drawn backwards from the eye" —betokening introspection and concentration; the bowed head characteristic of the thinker, and the supporting hands,—that gesture which has always something pathetic about, it—as though the strong hands of the body were giving support to the troubled mind. The mental world of this thinker is symbolically represented by the spiral convolutions, expanding in wider and wider sweeps, while his inspirations or impulses for action are marked by the indented, radial lines. The deepest indentation marks the definitive and determining inspiration under the ægis of which he will, for good or ill, follow through his life to some significant end. The grille design supplementary to this relief, bears out this thought. The dominant inspiration is represented by the continuous ray, which, passing through the barriers of doubt and ignorance, pursues its unbroken way. Other inspirations, other compulsions, are represented by the non-continuous rays; these are less perfect. The tangent rings, of successively increasing diameter, represent the successive phases of his life.

Such, in its outline, is the meaning of the symbols used. Similar symbolism runs through the whole series. Its authors have had the ingenuity and the courage to envisage the union of the fixed forms of geometry with the unstable and evanescent attributes which form the unmeasurable substance of the emotional and intellectual life. Whether the union has brought forth progeny whose æsthetic quality will stand, is something for the critics to decide. As an expression of a method of achievement, the work may be characterized assuredly as not lacking in the spirit of adventure. For my own part, I confess that I have rarely looked upon relief figures which have struck me as more worthy of praise than these. To say that they are masterly is not enough; they hold, for those of us who care for abstractions, what is far more important,—something of genius.

THE CHANIN BUILDING

SLOAN & ROBERTSON, ARCHITECTS

BY

MATLACK PRICE

ALREADY the multitudinous throng that finds its daily tasks in and about mid-town New York is accustomed to the Chanin Building, and tarries no more in its ceaseless coming and going to look up into the sky. So quickly are the achievements of this age accepted and assimilated! With imaginations released, perhaps, for more lofty flights after dark, there may be more whose eyes are drawn 670 feet aloft to an architectural island floating there in the sky,—the upper stories of the Chanin Building, floodlighted, glowing silently and beautifully, seemingly in another world,—immeasurably removed from the clamorous life of the street level.

But the Chanin Building must be seen as more than the latest great mid-town office structure, as more than merely the third highest of the towers of Manhattan. It is a splendid contribution to twentieth century architecture in that it powerfully rationalizes all the novel features of this new style,—and it is a splendid contribution to the architecture of all time because it is good design.

The architects have not here compromised a fine vision either with major errors in scale or with minor trivialities. This is the realization of a fine vision of a great tower, rising sheer above a massive sub-structure. This base, itself a building of impressive proportions, is composed of receding masses, all mounting upward,—then the tower is given sheer height, uninterrupted, not weakened,—up to the vigorous silhouette of its top against the sky. At the street level there is interesting design,—detail where detail can be seen,—a bronze frieze along above the shop-fronts, unusual entrance shelters, with self-contained lighting, and above the street floor an all-over pattern of modeled terra cotta. There are those who feel that this pattern is out of scale, and that it is perhaps a dangerous architectural adventure from the point of view of design. But a change in scale may well prove to be one of the astonishing changes that twentieth century design brings with it. This is a large building, large enough, perhaps, to create a few laws of its own.

If the major premises of twentieth century architecture are accepted,—and their acceptance cannot be long withheld,—even the most conservative must accept many minor expressions in design and ornament that are as logical a part of a Chanin tower as classic friezes were a logical part of the Parthenon. Like the New York Telephone Building, the Chanin Building is an impressive realization of the most hopeful predictions that were made years ago, when the zoning laws first imposed the set-back restriction on tall structures. At once it became necessary to design in masses rather than in facades. The facade always offered too strong a temptation to create "paper" architecture. Buildings were not so much buildings as they were sets of elevations,—and elevations, of course, had to be detailed, and they were! With a paper elevation tacked down on the drawing board, the crowning stories of a 30- or 40-story building looked like as good a place to put a lot of fine detail as did the stories down at the street level. And, designing carefully "in scale,"—on paper,—the detail far up aloft usually corresponded exactly to the detail that was to be seen down at the entrance. The result was that buildings were detailed rather than designed.

Now structures like the Chanin Building are designed in great vigorous masses, and are detailed only where detail will mean something,—that is, where it can be seen at fairly close range. The top of the Chanin tower is a splendid piece of mass design, being neither abruptly blunt nor weakly tapered off. At the risk of expressing what may be purely a personal reaction, though I believe there is more to it, I feel impelled to make here certain observations about this matter of terminating towers, and especially the towers of these new buildings of which mass and massiveness make the keynote. Is it not a fallacy, and a contradiction of essential form, to weaken the top of a massive structure with a point or a spire? It is very often done, perhaps because of a lingering memory that the spires of Gothic cathedrals, pointing heavenward, give an effect of mounting upward, thus symbolizing the aspirations of man,— and so forth. But how about Durham Cathedral, with its superb, square-topped Norman towers? Or, for that matter, Westminster or Notre Dame? Given certain basic changes in manner and scale, what would the Woolworth Building gain in majesty without a spire? What would the Chanin Building look like *with* a spire? I do not mean to compare these two buildings, for they are expressions of two quite different eras. I merely want to raise the question as to whether or not there may not be something very like a sentimental fallacy about spires and points on towers,—some unexamined notion that they add an elegant and proper "finish." In terms of abstract design (forgetting buildings), a cone or a pyramid is weaker than a cube. In the design of a massive building, can a tapering shape do anything but weaken the whole effect? As an experiment, imagine the New York Telephone

Building finished off with a pyramidal top! Perhaps it takes a little more courage to terminate a tower squarely and vigorously,—but that very courage is expressed in the resulting effect. It may be that tradition has such a strong hold on us that architects do not stop quite soon enough when they are designing towers. They complete a great four-square tower and, failing to realize its completeness, they top it off with slanting lines that defeat much of the effect of sheer height that they might have attained. No such weakness mars the effect of the Chanin Building. Looking up at its great mounting silhouette, it seems as though a successful architectural paradox has been accomplished,—a building that possesses both mass and height.

In the old days when the first "skyscrapers" began to amaze and slightly worry the architecturally minded, the question of possible heights was much discussed. The whole idea was new, and skepticism flourished. It was seriously doubted, by many, that the Flatiron Building would withstand a heavy broadside wind. It might blow over! Flying machines were, demonstrably, impossible, though many daring seers voiced their belief that a day might come when automobiles would be almost as numerous as horse-drawn vehicles! When the structural height limit of steel buildings came to be realized as far greater than had ever been supposed possible, it seemed to many that there must be an æsthetic height limit,—that too great a sheer height must prove distressing to the eye as well as impossible of any legitimate architectural treatment. The new type of building has solved that. Now a great coördination of masses can be piled up to a height even greater than that conceived a generation ago for a tower, and from the summit of this mass there may rise a tower that climbs upward to an altitude far greater than that of the building it springs from. The result, as we now have tangible evidence, has a new and vigorous beauty, entirely its own and entirely unlike anything the world has ever seen. The architect no longer needs to decide whether he will design a massive building or a tower,—he can do both in one gigantic composition. The new apartment houses are rapidly realizing the possibilities afforded by the terraces that lie upon the shoulders of their set-backs, and these are being utilized as gardens, far above the noise and confusion of the streets. There are terraces, too, on the shoulders of our new towering office buildings, and it cannot be long before these too will be utilized as glassed-in studios or "daylight" offices, —perhaps whole rooms of glass, in which the modern executive will recoup from the sun's energy what he expends in his daily labors!

Returning once more to design, it seems indeed that the architect's only course in designing structures such as the Chanin Building, is to break courageously with the past. There is no architectural precedent for this new type, and if old details are to be used at all they must be used very sparingly and in a much modified form. The Chanin Building does not need pilasters and garlands and consoles and all those old familiar bits of bric-a-brac that have well and faithfully served their purpose through many years, and it has been found that it is only ridiculous to set urns and obelisks on the parapets of the great set-backs of the new buildings,—a practice at first followed through some lingering notion that this might confer a refining touch,—when the very scale and majesty of the whole composition magnificently transcends any necessity for there being such artificial and relatively trivial accessories.

Editor's Note. No presentation of the Chanin Building could do it justice or be complete without some description of the very remarkable and beautiful entrance vestibules, concourse and elevator lobby. All of the interiors of the public part of this structure as well as the superb suite of offices to be occupied by the Chanin firm on the 52nd and 53rd floors were designed and executed by the architectural department of the Chanin Construction Company, of which Irwin S. Chanin is president and J. L. Delamarre, the department head. These lobbies and the concourse are splendid examples of the unlimited possibilities of the modern style of interior architecture and decoration. Here, as may be judged from several illustrations shown on the plate pages, marble and bronze have been combined in most interesting and artistically original designs. Rayne Adams' article on the reliefs and grilles of the main foyer or concourse, which extends through the building from 41st to 42nd Street, gives an excellent idea of the immense amount of thought and study which was expended by Mr. Chanin and his able assistants on the design and decoration of the public areas. Unlike the architectural decoration found in the interior of the New York Telephone Building, where floriated forms were chiefly used, geometrical shapes and devices in unusual and beautiful designs here characterize all of the architectural ornamentation. The use of colored marbles combined with brass and bronze for the walls and floors gives a warmth of color which is one of the features of all modern interior design. The treatment of the several show windows opening from the stores onto the concourse has a distinctly contemporary French feeling. Decorative bronze door frames and over panels are of particular interest. Such details as the large lanterns of the concourse, the directory board, the mail box and the doors and walls of the elevator lobby have been designed with great care.

Photo. R. S. Grant

Plans on Back

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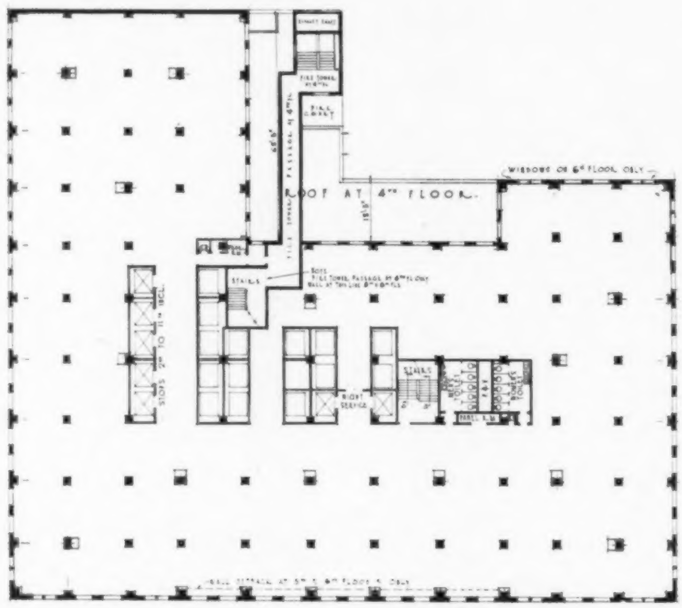
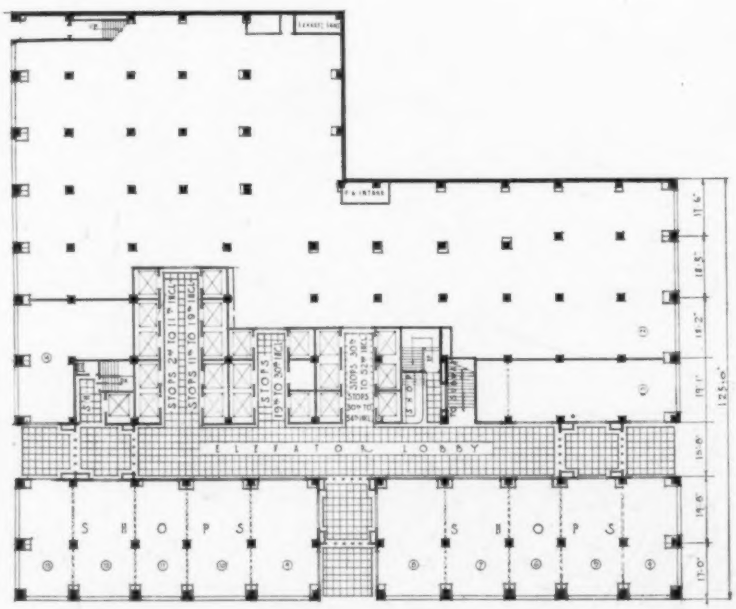
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

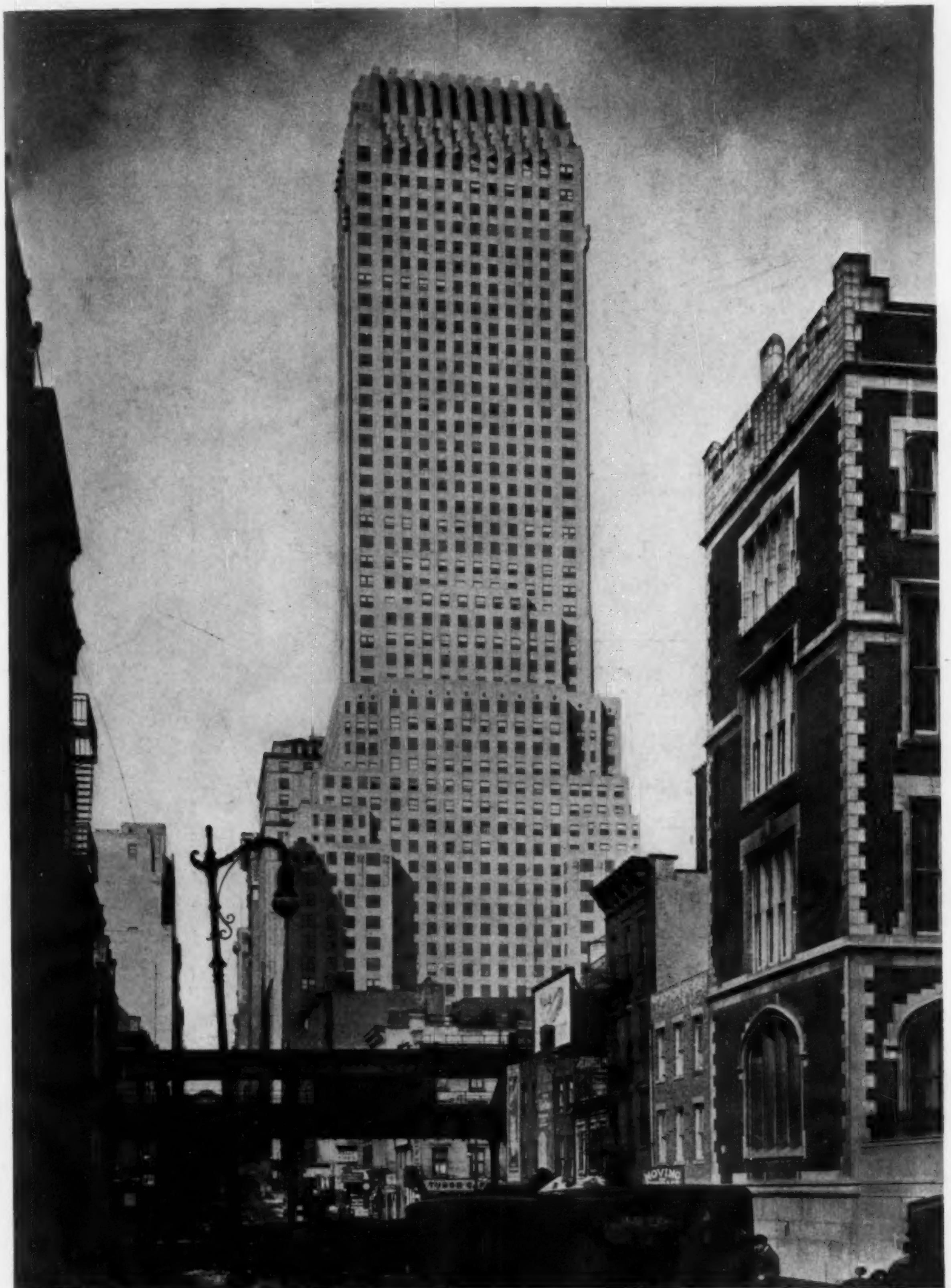


FOURTH TO SIXTH FLOORS



GROUND FLOOR

PLANS. CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

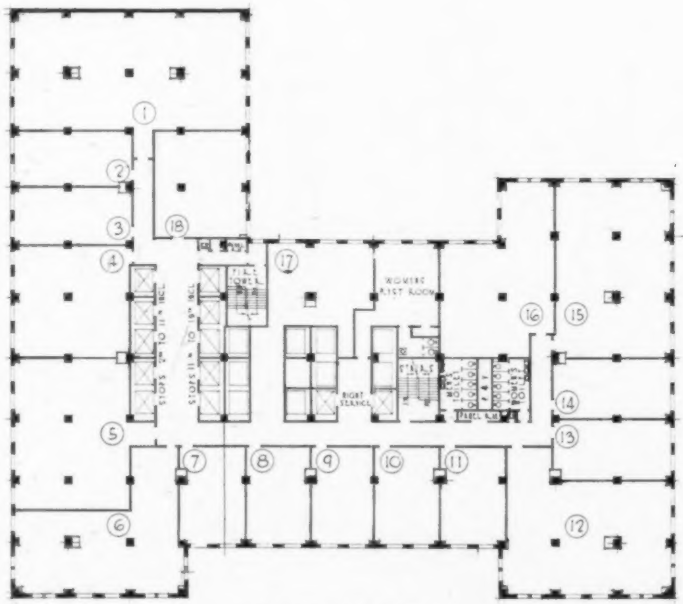


Photos. Sigurd Fischer

Plans on Back

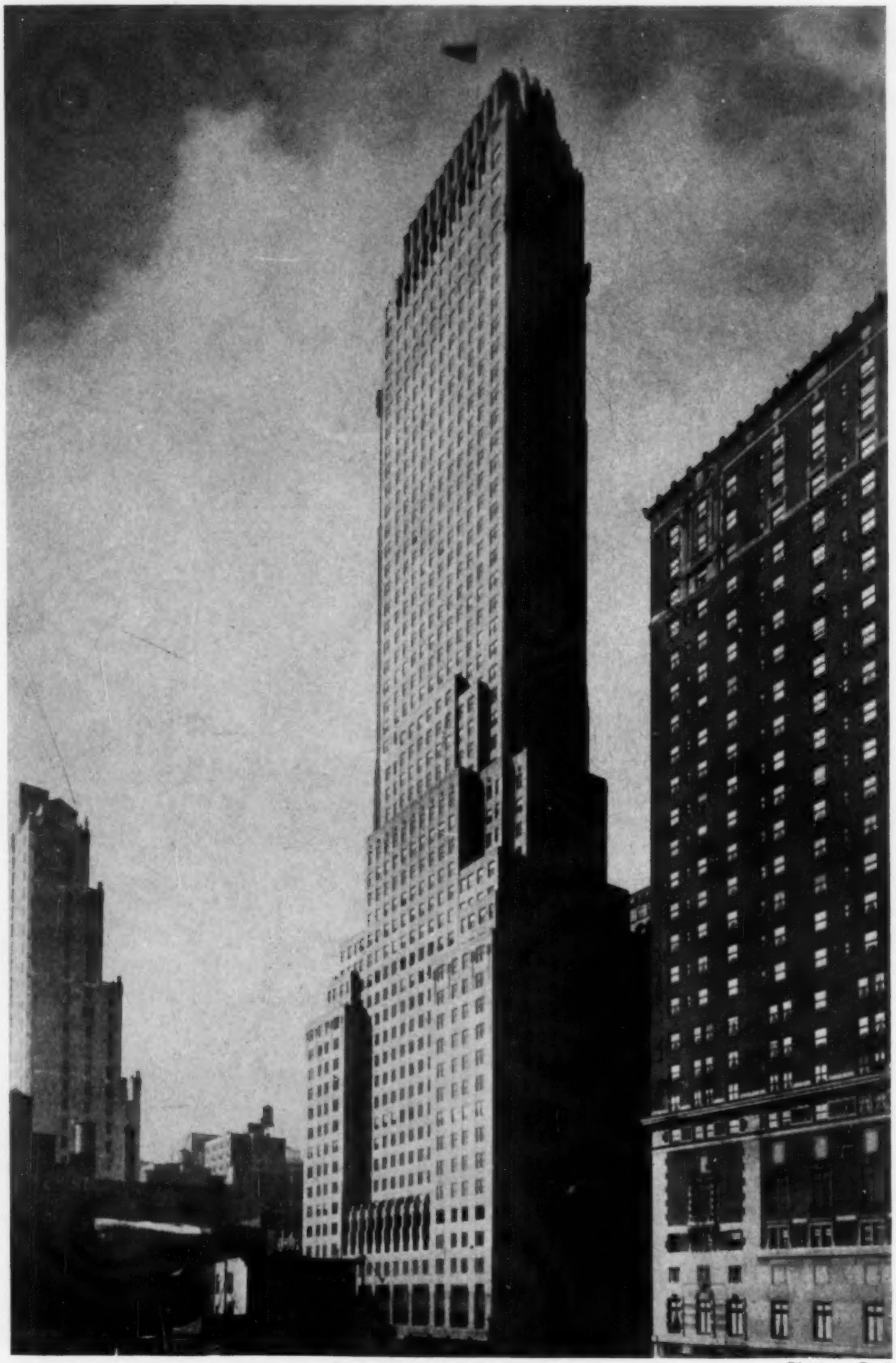
VIEW FROM EAST 41ST STREET
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

TWENTY-SECOND TO TWENTY-FIFTH FLOORS



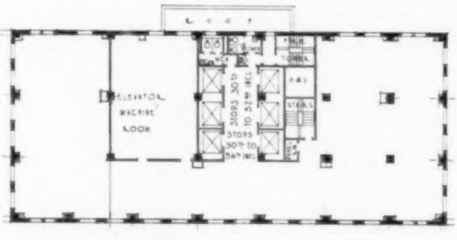
ELEVENTH FLOOR

PLANS. CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

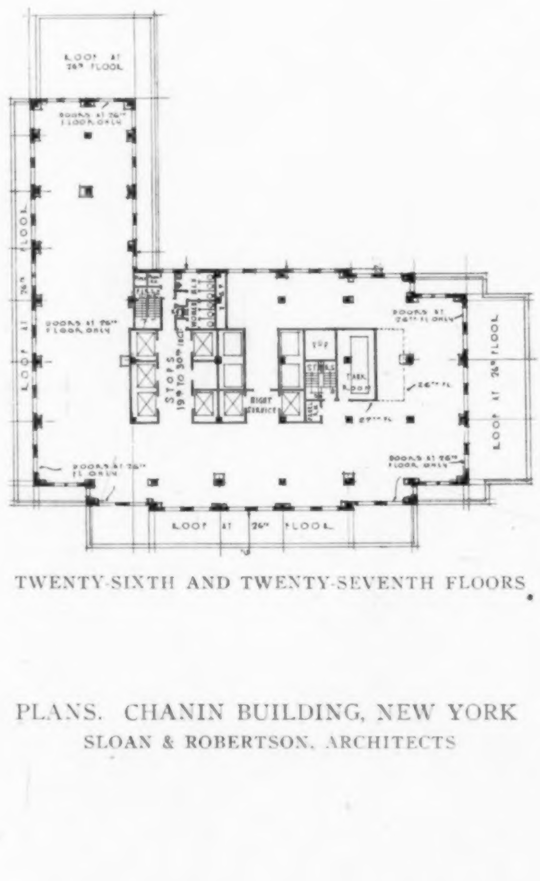


Plans on Back

LEXINGTON AVENUE FACADE
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS



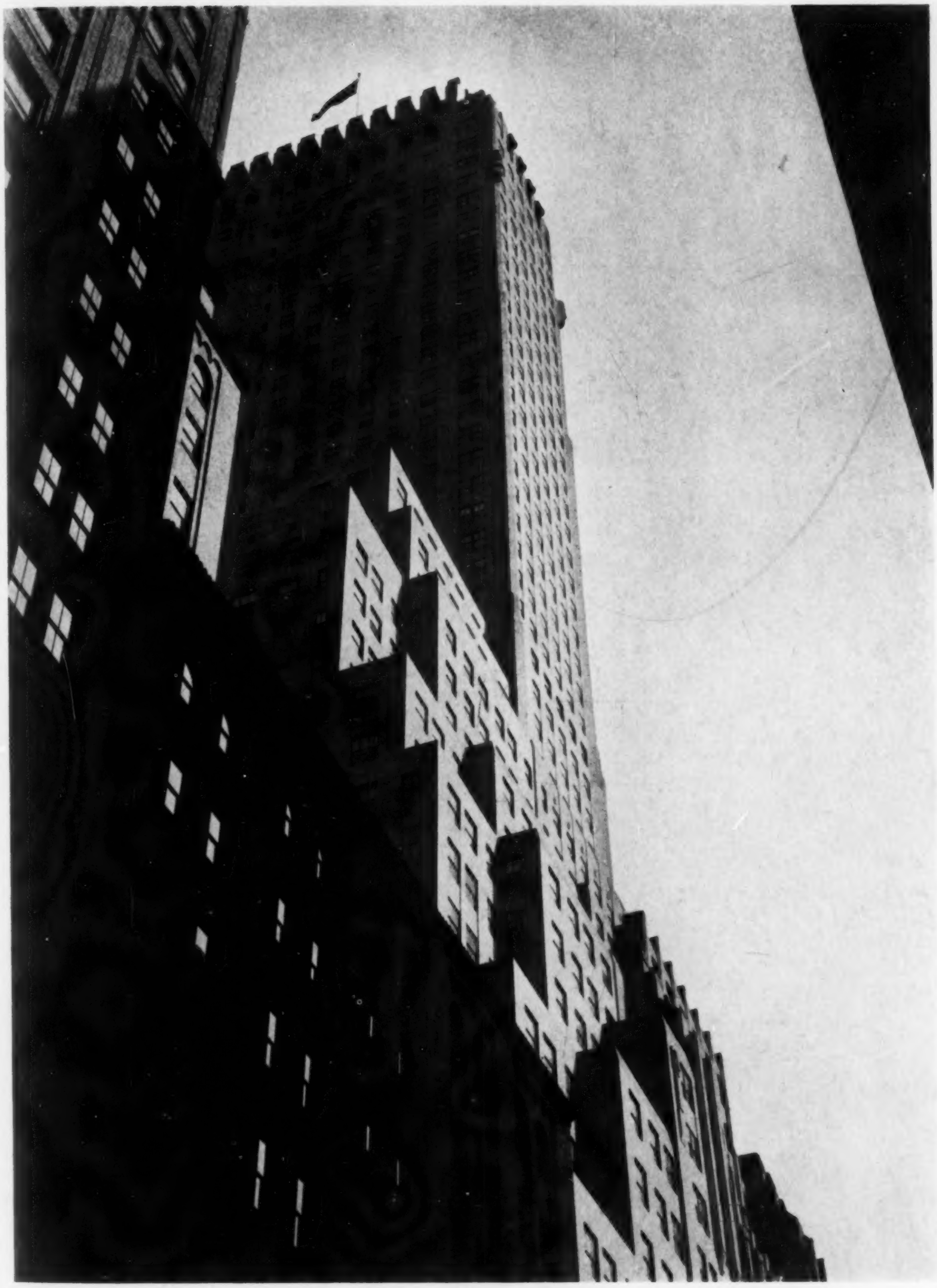
THIRTY-SECOND FLOOR



TWENTY-SIXTH AND TWENTY-SEVENTH FLOORS

PLANS. CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

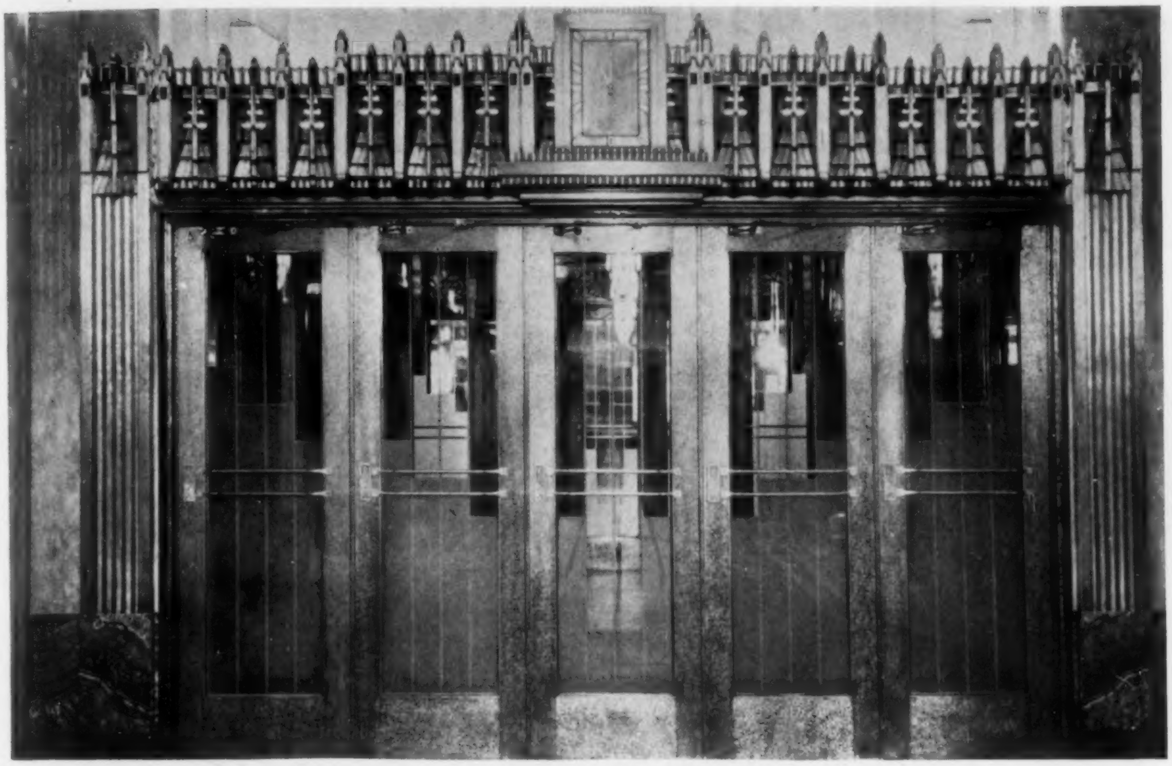
VIEW FROM LEXINGTON AVENUE
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS



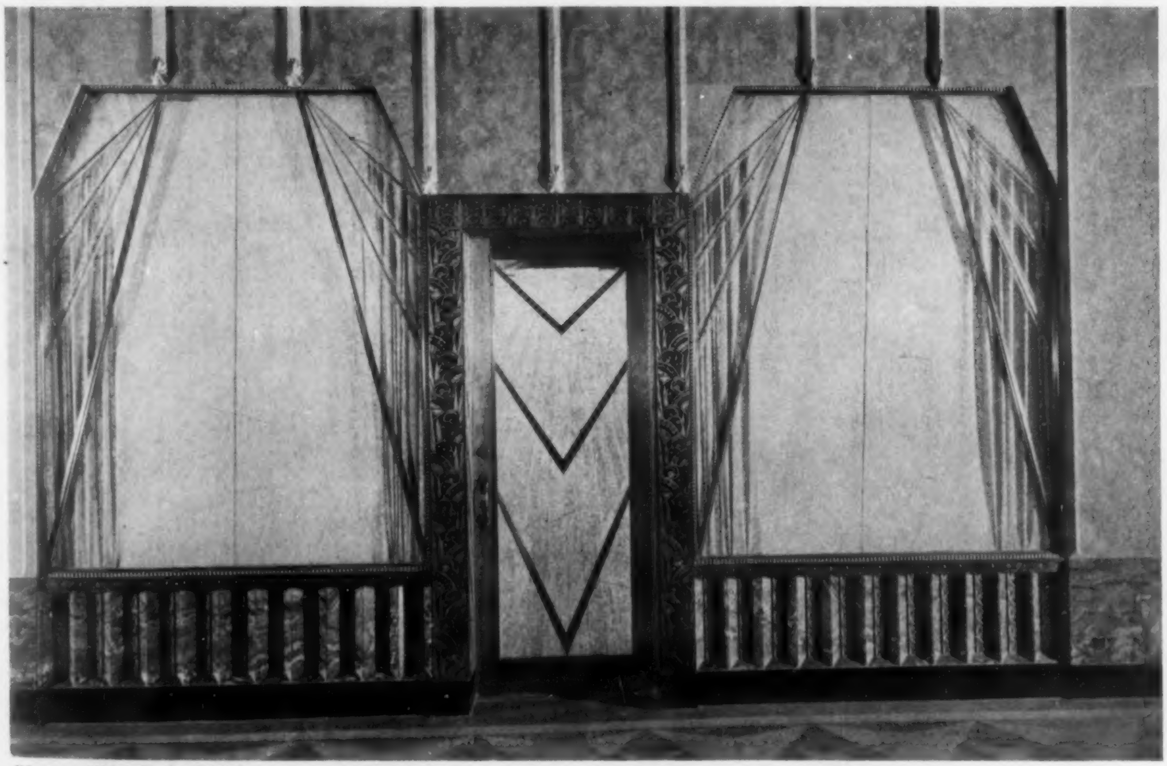
VIEW FROM EAST 41ST STREET
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

DETAIL OF UPPER STORIES
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

MAIN ENTRANCE
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS



ENTRANCE DOORS IN LOBBY



Photos. Albert Rothschild

SHOP IN LOBBY

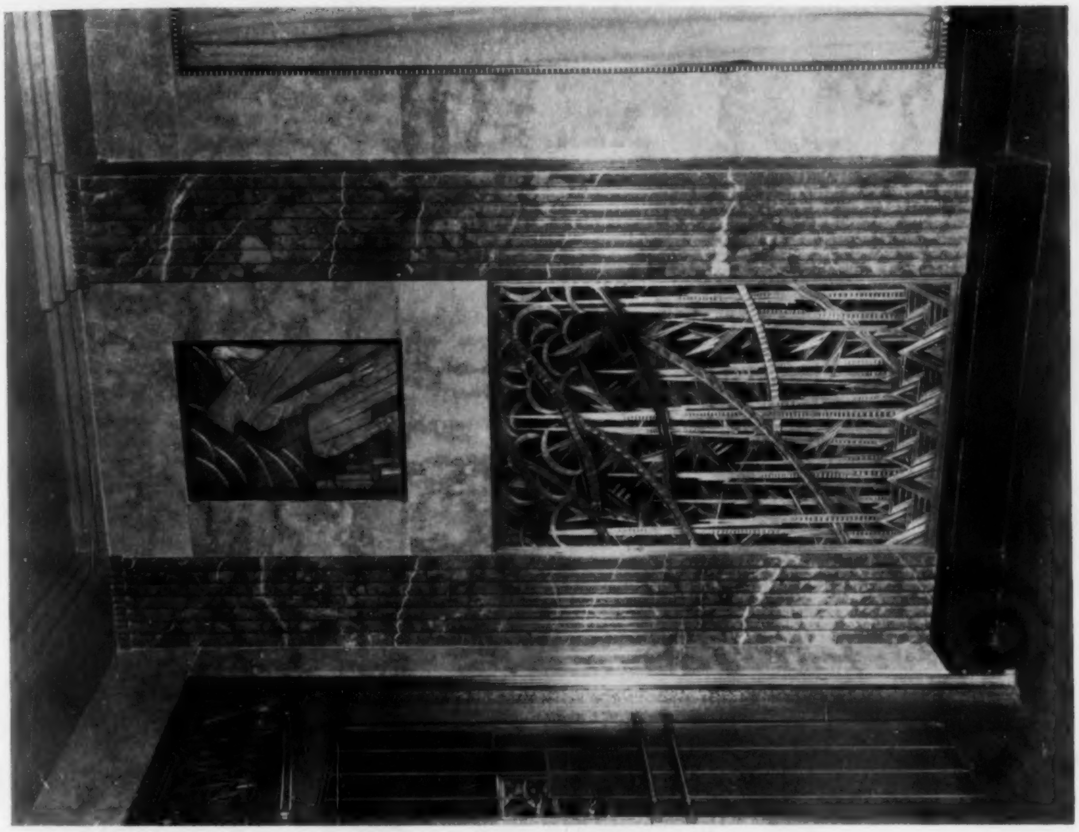
CHANIN BUILDING, NEW YORK

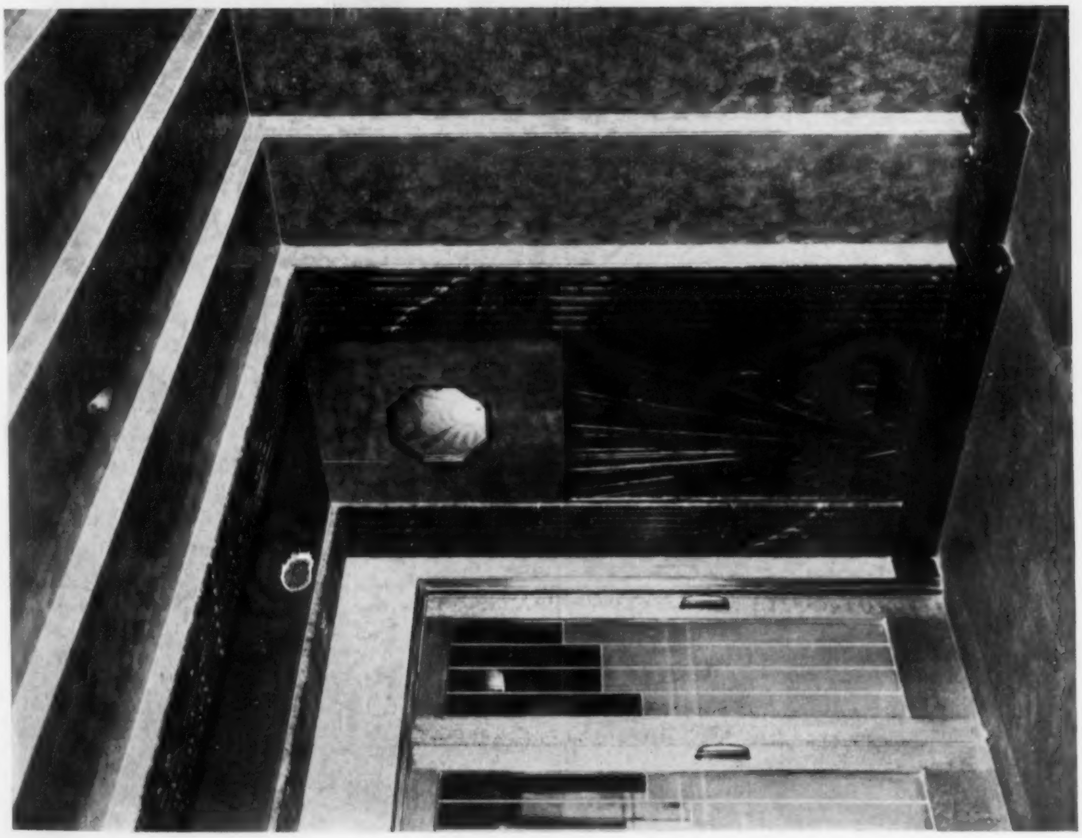
JACQUES DELAMARRE, ARCHITECTURAL DIRECTOR, CHANIN CONSTRUCTION CO., DESIGNER

LOBBY

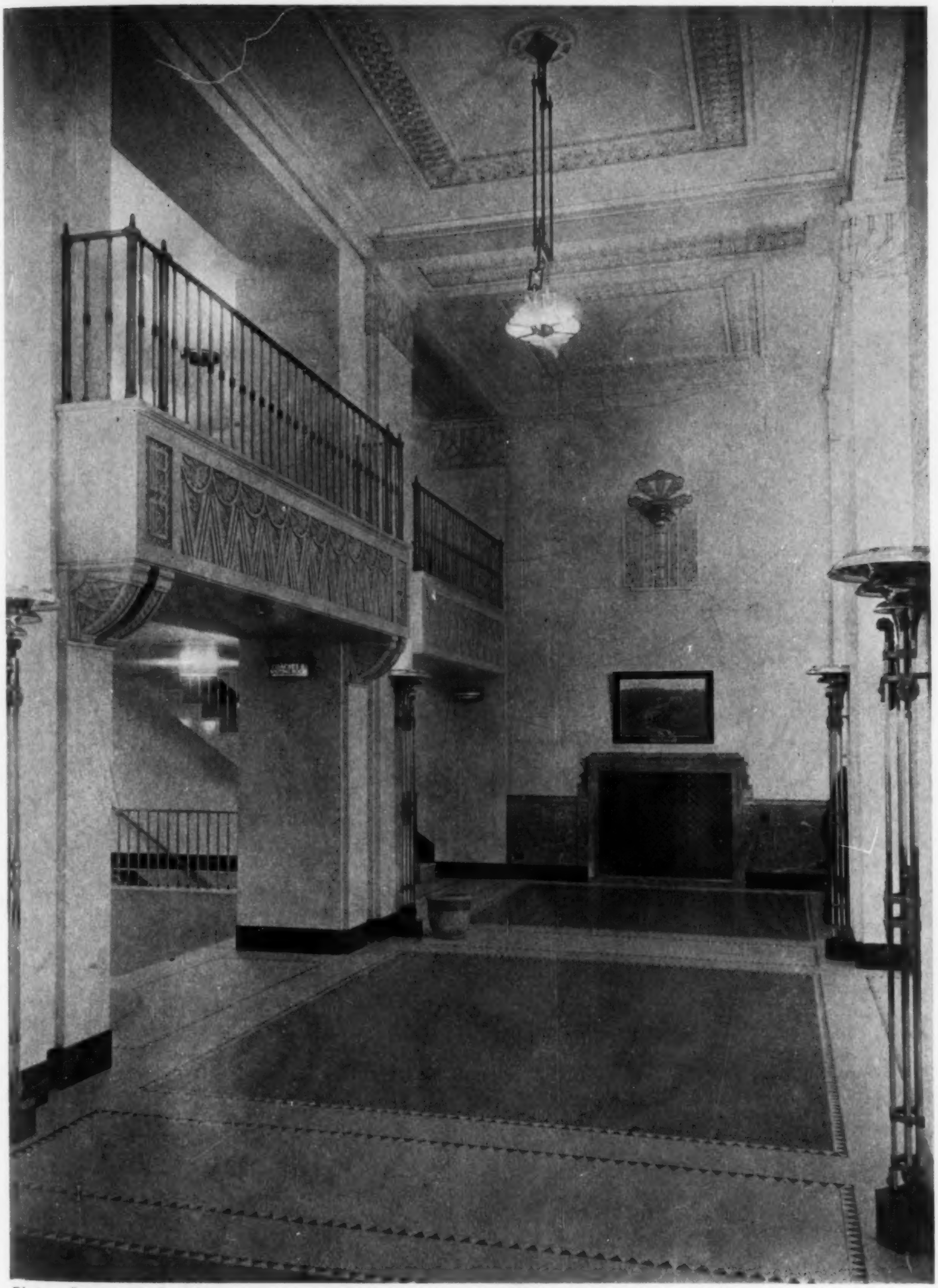
CHANIN BUILDING, NEW YORK

JACQUES DELAMARRE, ARCHITECTURAL DIRECTOR, CHANIN CONSTRUCTION CO., DESIGNER





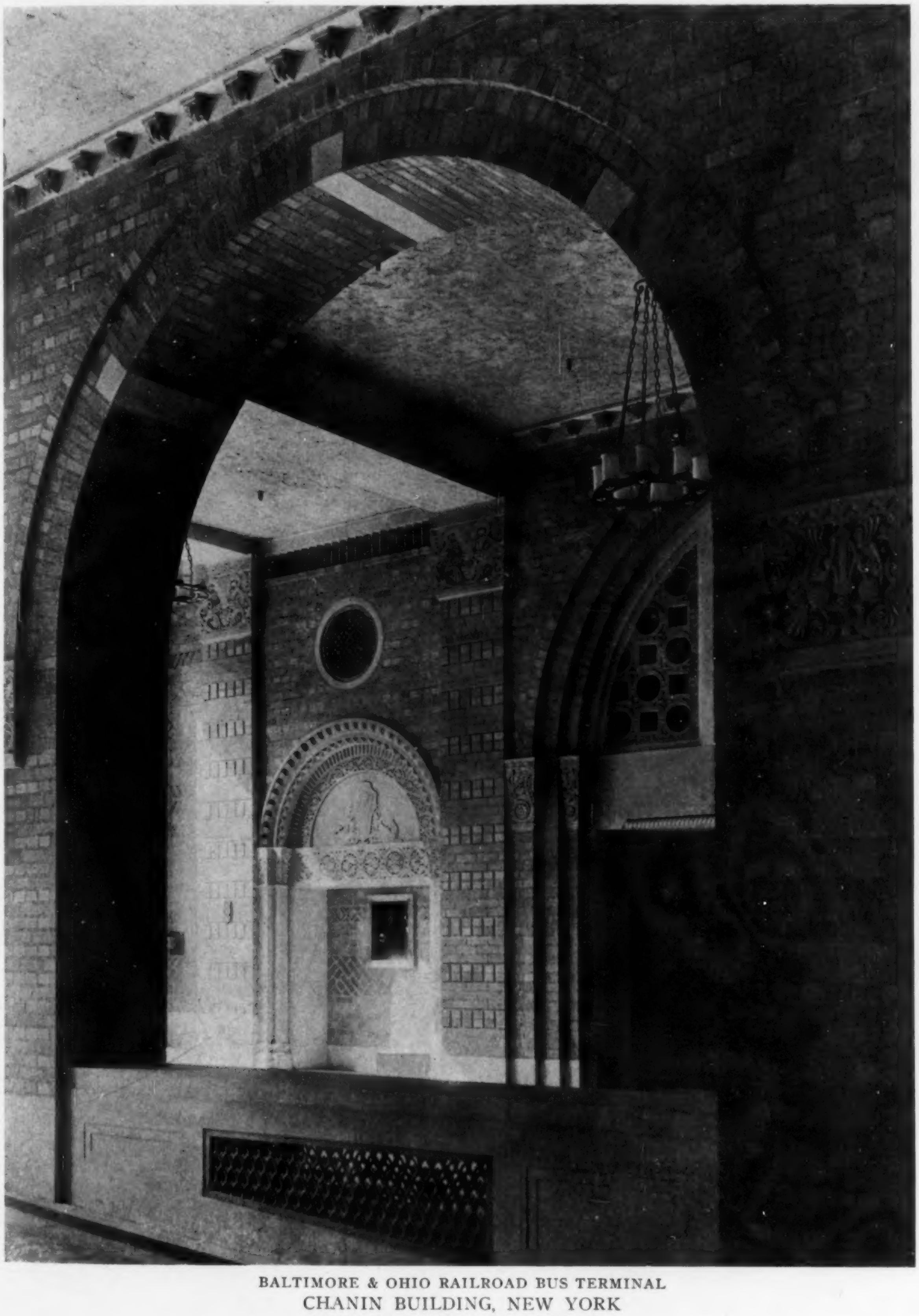
RELIEFS AND GRILLES IN VESTIBULE
CHANIN BUILDING, NEW YORK
JACQUES DELAMARRE, ARCHITECTURAL DIRECTOR. CHANIN CONSTRUCTION CO., DESIGNER



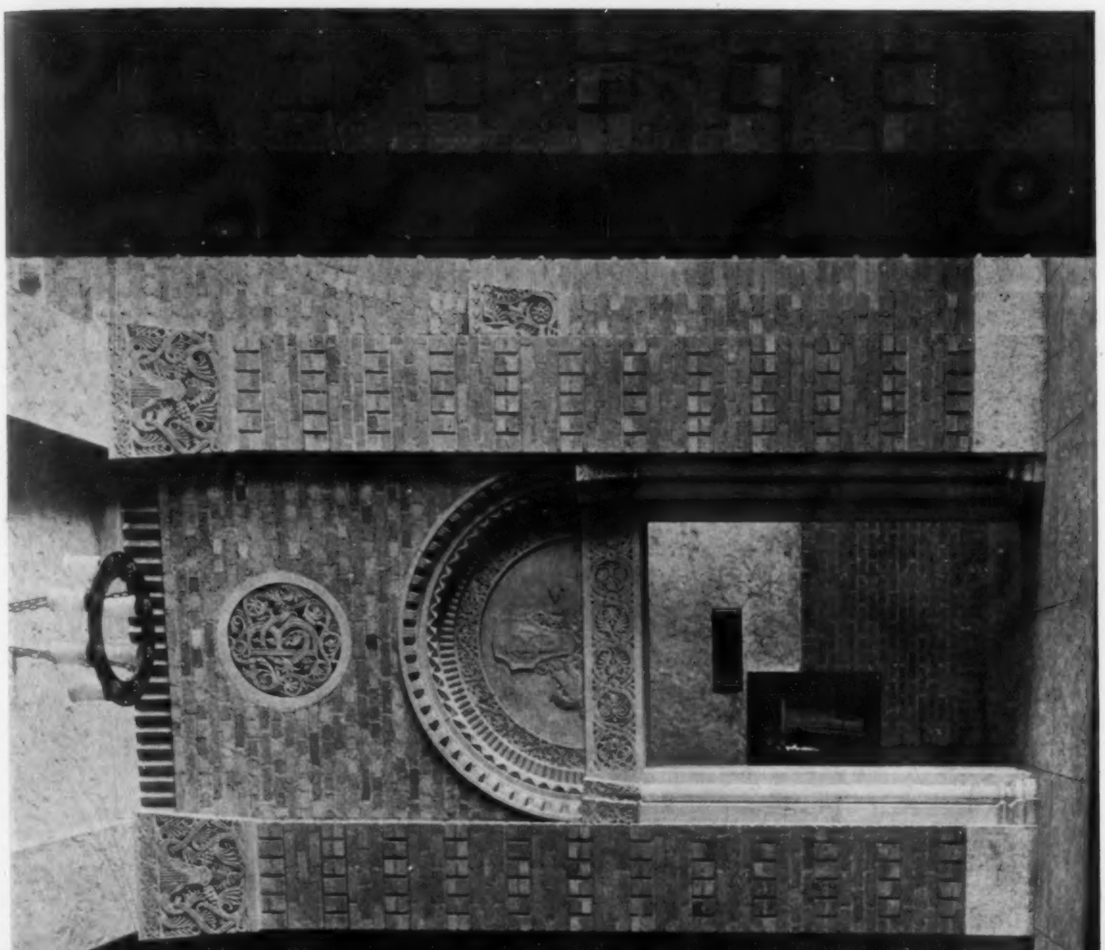
Photos. Samuel H. Gottscho

BALTIMORE & OHIO RAILROAD OFFICES
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

BALTIMORE & OHIO RAILROAD OFFICES
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS



BALTIMORE & OHIO RAILROAD BUS TERMINAL
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS



BALTIMORE & OHIO RAILROAD BUS TERMINAL
CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS

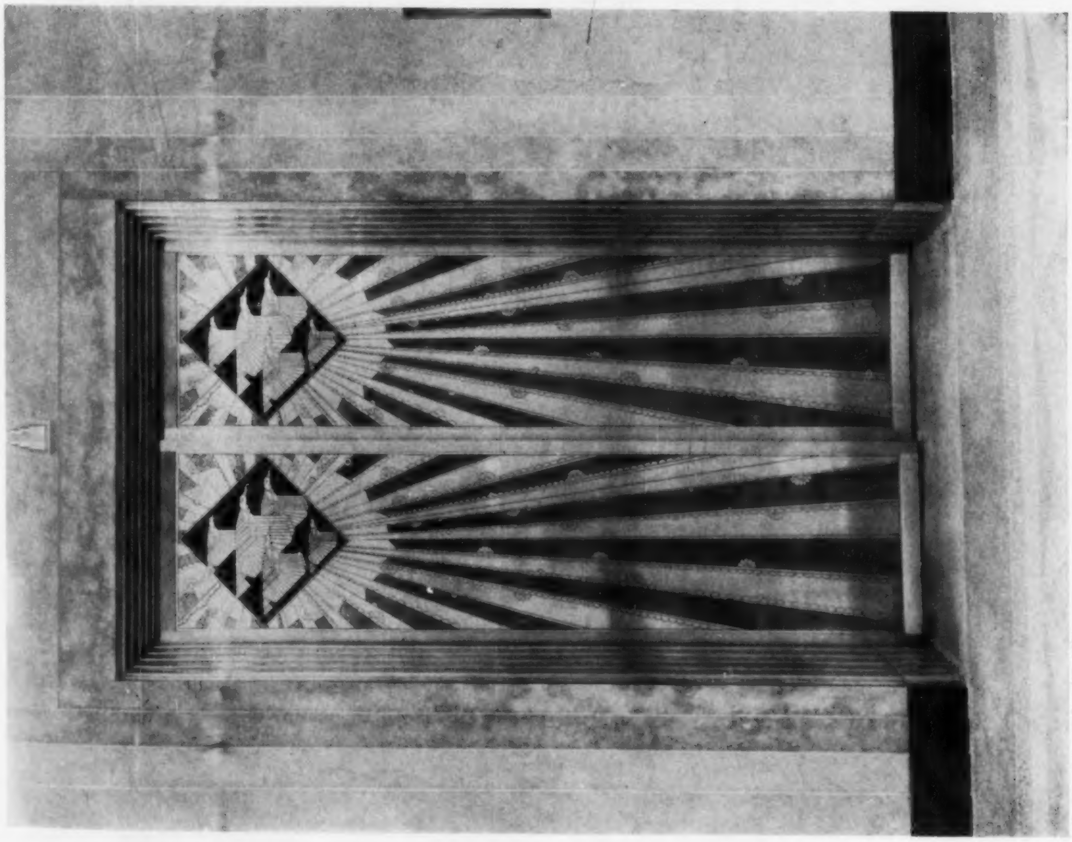
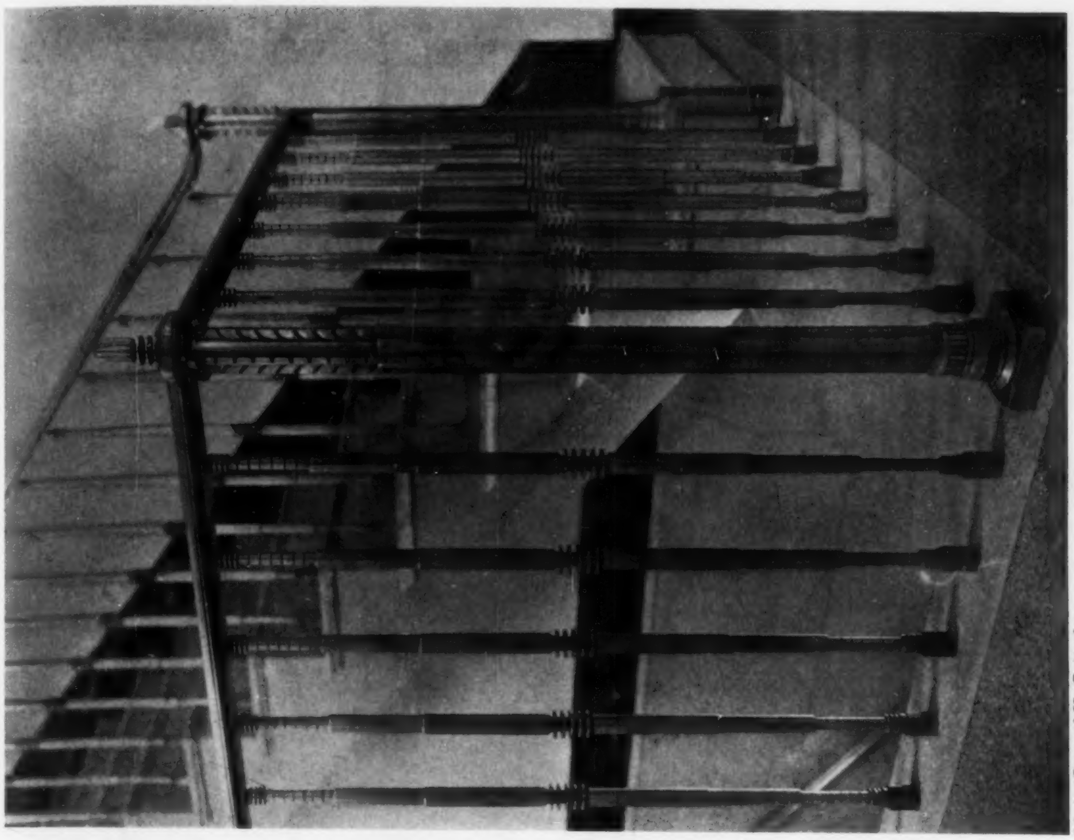


Photo. Albert Rothschild

ELEVATOR DOORS IN LOBBY
JACQUES DELAMARRE, ARCHITECTURAL DIRECTOR
CHANIN CONSTRUCTION CO., DESIGNER



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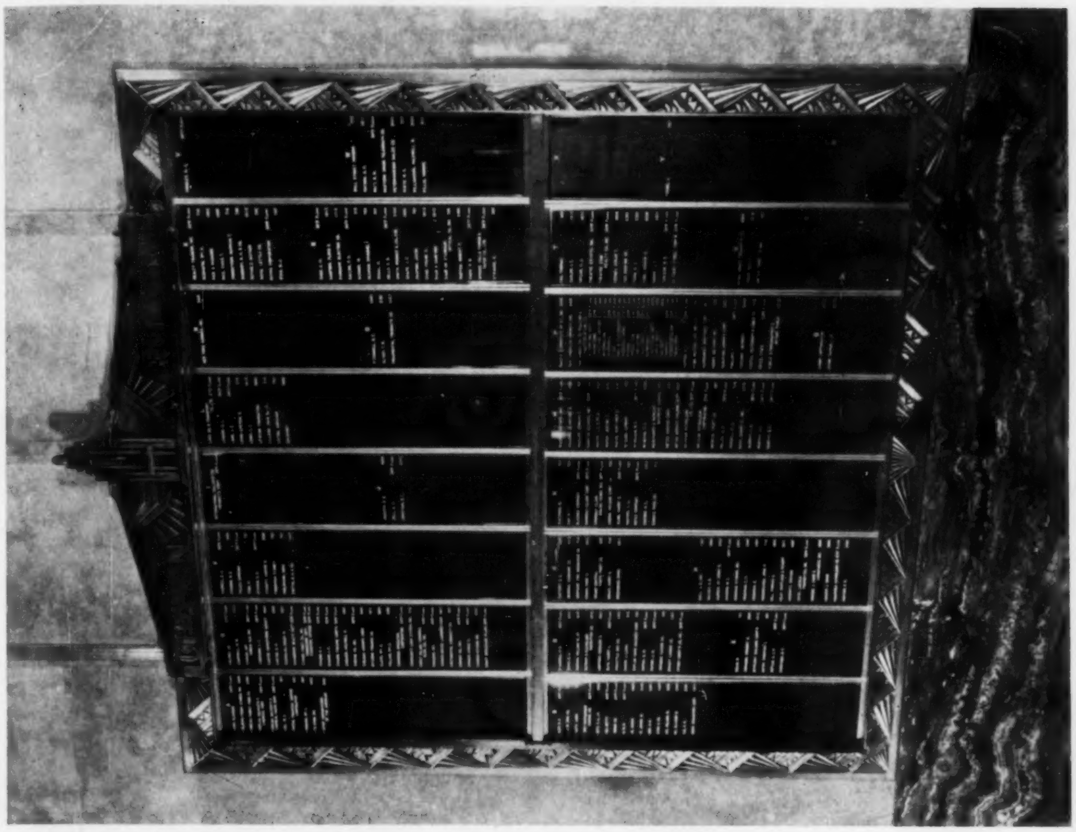
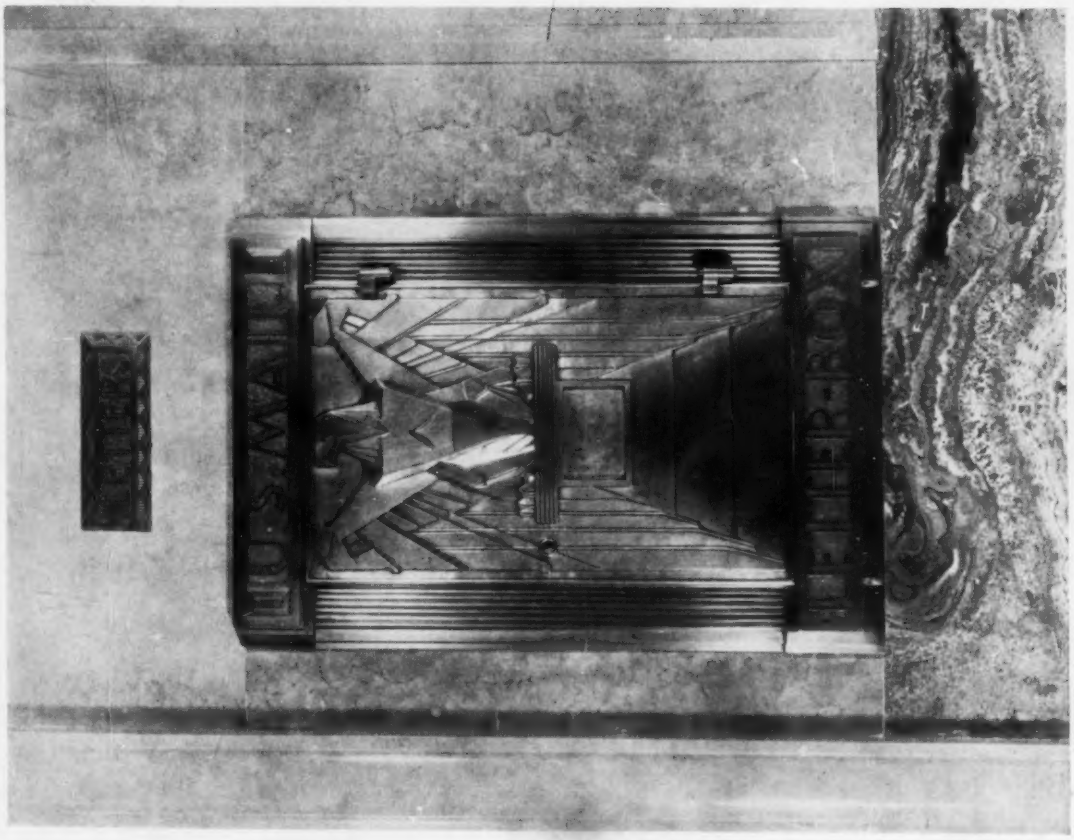
STAIR RAIL, BALTIMORE & OHIO RAILROAD OFFICES

CHANIN BUILDING, NEW YORK
SLOAN & ROBERTSON, ARCHITECTS





Photos. Albert Rothschild

LETTER BOX DIRECTORY

CHANIN BUILDING, NEW YORK

JACQUES DELAMARRE, ARCHITECTURAL DIRECTOR, CHANIN CONSTRUCTION CO., DESIGNER

TWICKENHAM HOUSE, ABINGDON, BERKS.

BY

HAROLD DONALDSON EBERLEIN

TWICKENHAM HOUSE, in East St. Helen's Street, at Abingdon, is a very old house, much older than one would fancy from its exterior. As a matter of fact, there are records of the house in Shakespeare's time, and documentary indications are not wanting to show that it was not new even then. Its appearance, however, within as well as without, utterly belies its real age.

Like many other old houses to be found in the towns, villages and open country, throughout the length and breadth of England, Twickenham House wears the livery of the eighteenth century, a garb put on when it had already attained mature years. In its decorous Georgian exterior it bears witness to the great building activity that marked the period when the merchant and professional classes had become prosperous and were able to spend money as never before. Their new prosperity prompted them to remodel their dwellings in the elegant manner of the day, and to surround themselves with material comforts and conveniences that the limitations of older domestic architecture could scarcely yield them; the Classic mode was more closely in accord with the changed manners and wants of the period. Consequently, over and above all the new construction then going forward in town and country, there took place an unprecedented amount of remodeling and refronting. The fashionable process of reconstruction became at times almost a mania, and it often altered the aspects of whole streets. Rows of houses shed their wonted mediæval features and blossomed forth with all the orderly amenities of new Georgian fronts. Internal structure frequently remained untouched, but re-faced exteriors were to be seen on every hand.

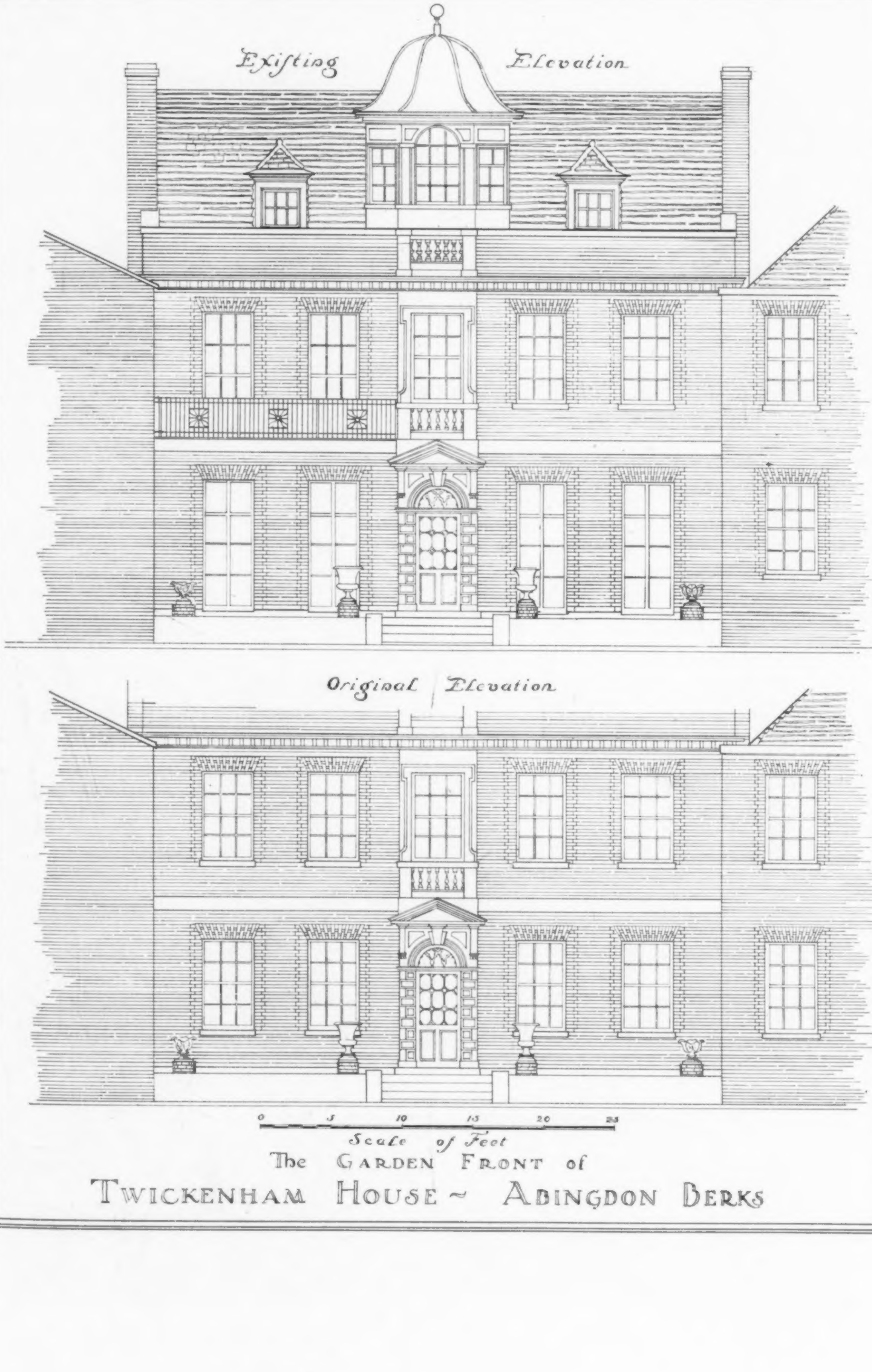
Those who could afford to do so did not stop at encasing the outsides of their old houses in new Classic jackets; they extended the rehabilitating program to remodeling and refinishing the interiors, conformably to whatever happened to be the current phase of the approved style; moreover, they often undertook extensive enlargements as parts of the schemes. There was money to spend, and there was a spirit of emulation abroad. Though labor was cheap and money had a relatively greater purchasing power than it has now, not a little of the remodeling was carried out

Twickenham House, Abingdon, Berks.

TWICKENHAM HOUSE ~ ABINGDON ~ BERKS

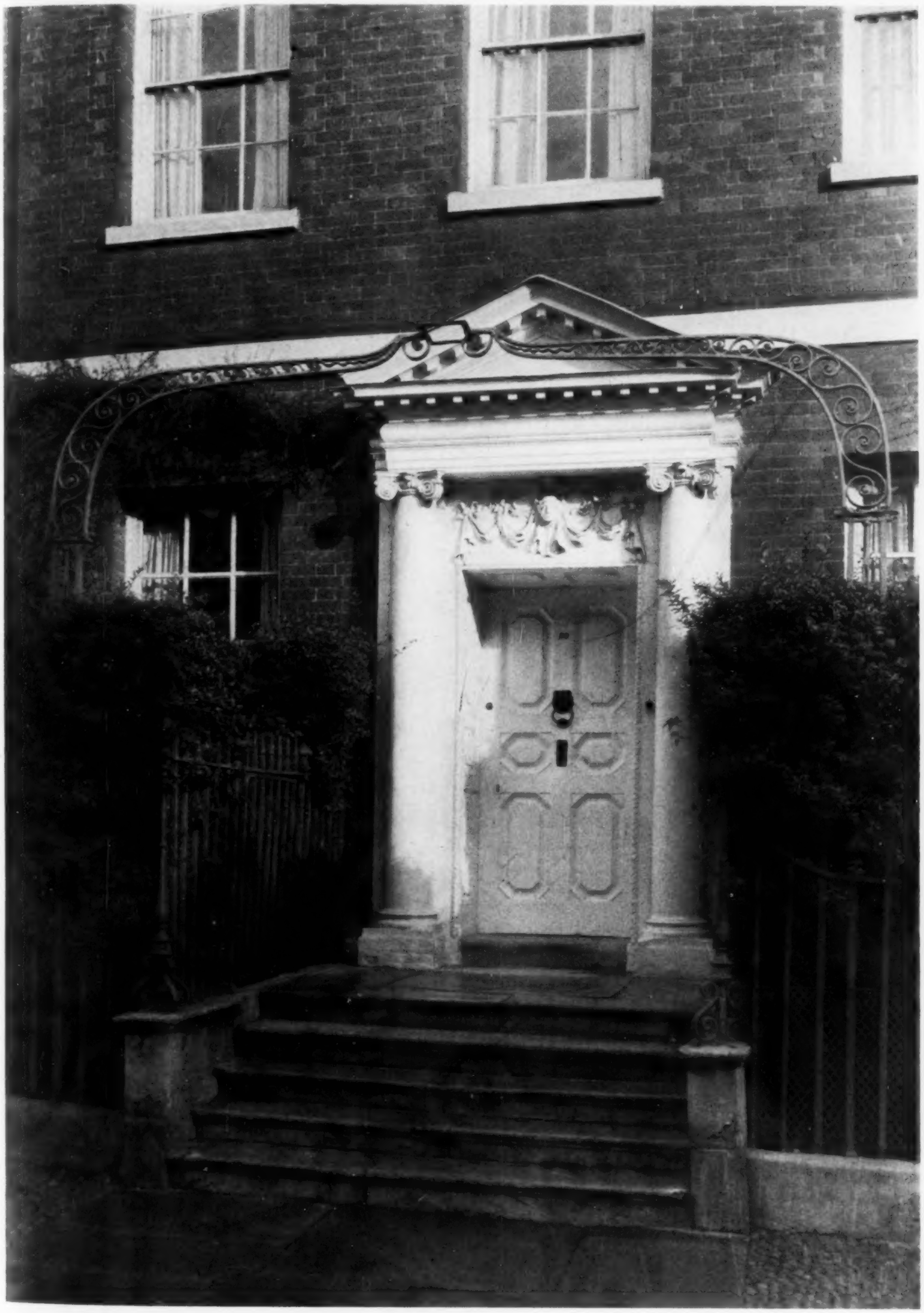
STREET ELEVATION

Scale ~ ⅛" = 1'-0"

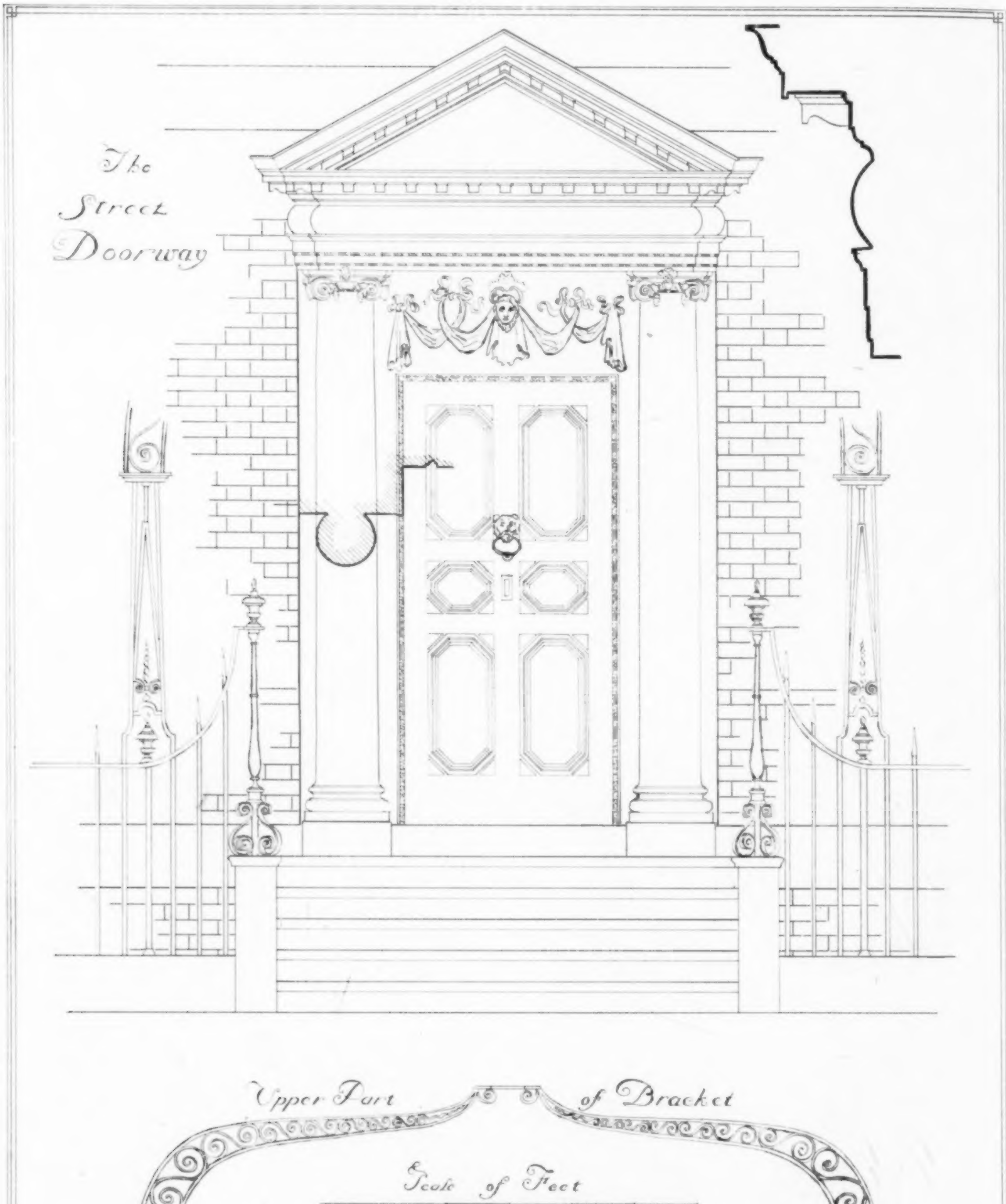


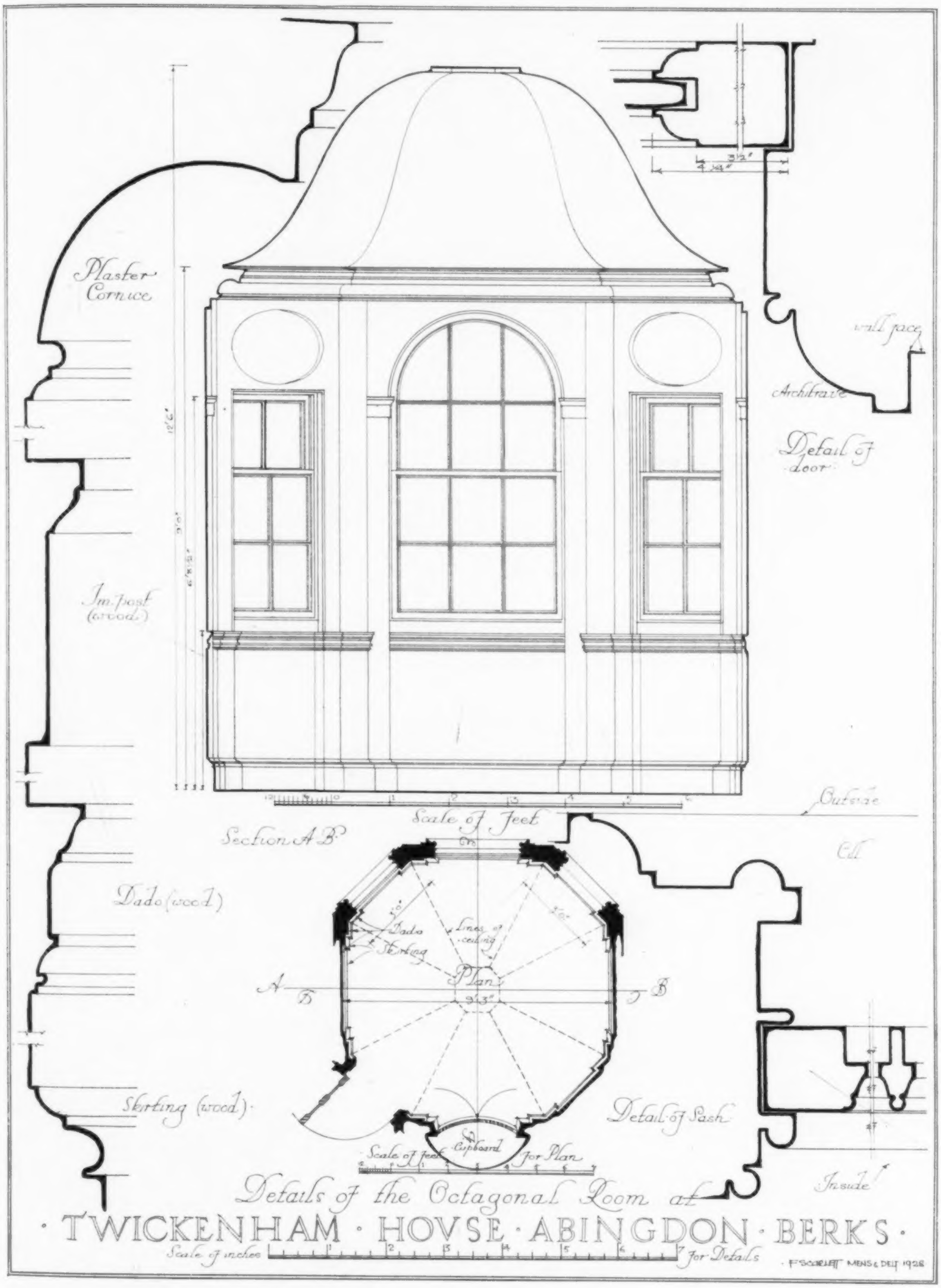
The Garden Front of
TWICKENHAM HOUSE ~ ABINGDON BERKS

STREET ELEVATION
TWICKENHAM HOUSE, ABINGDON, BERKS.

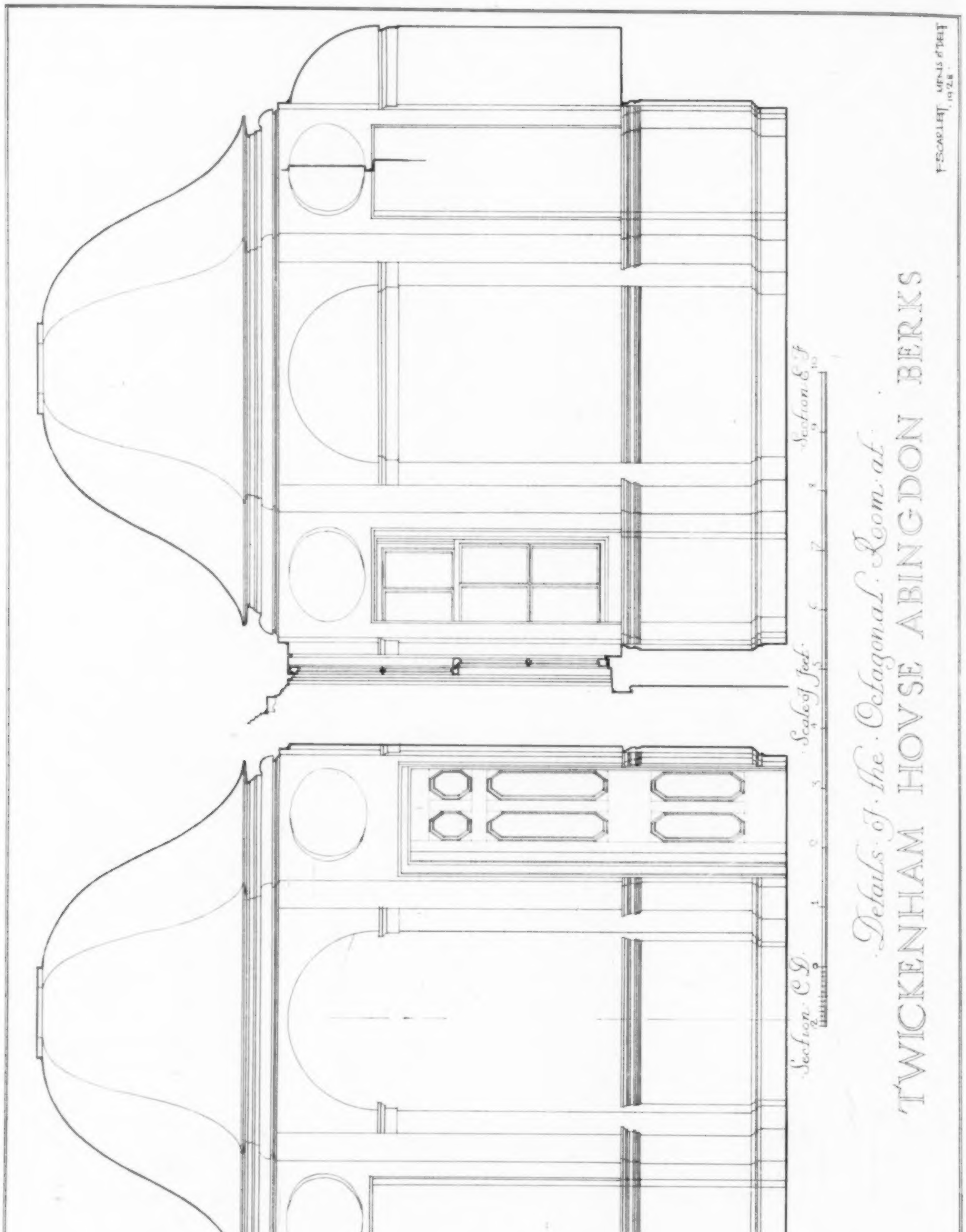


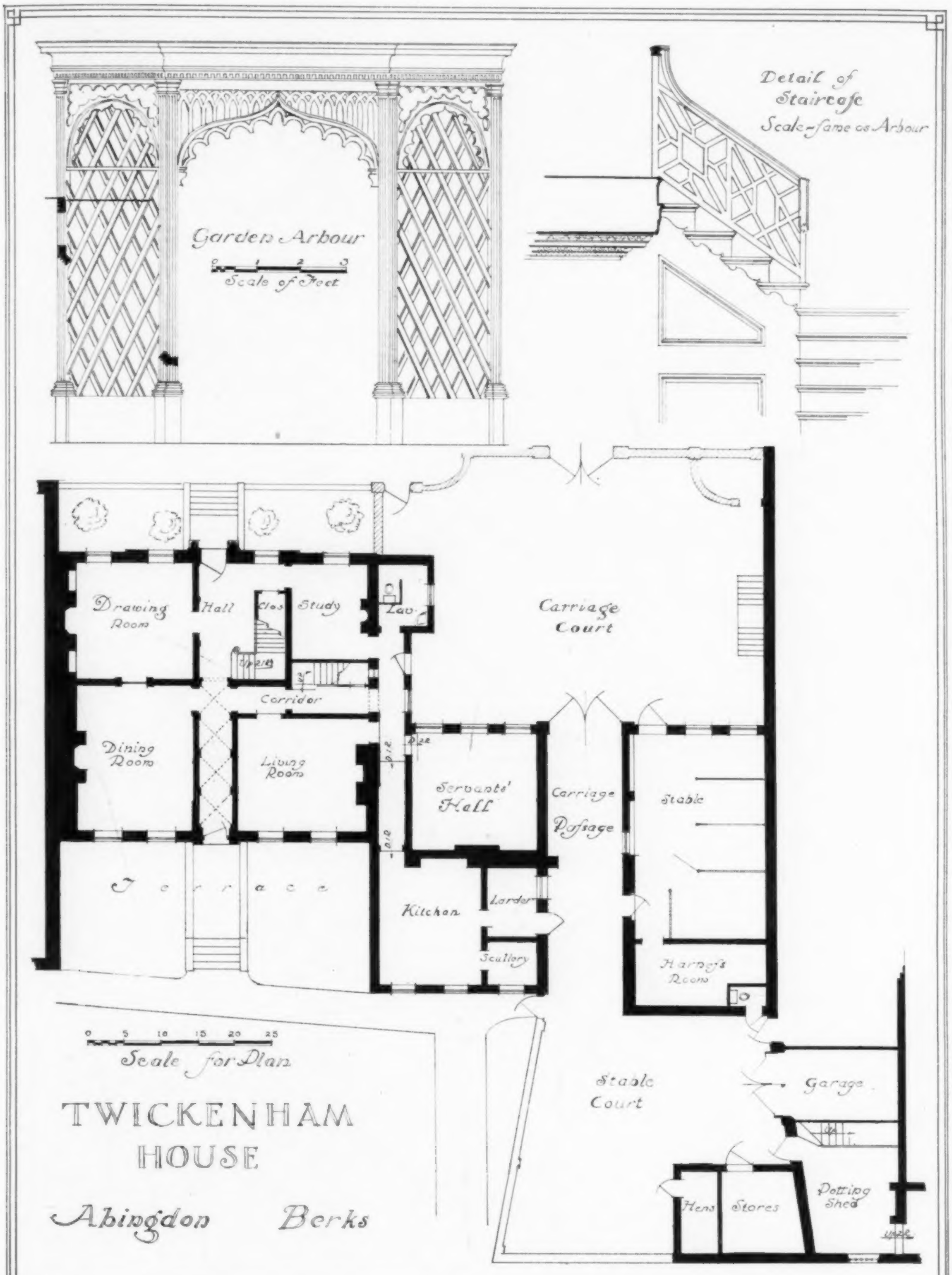
FRONT DOORWAY
TWICKENHAM HOUSE, ABINGDON, BERKS.

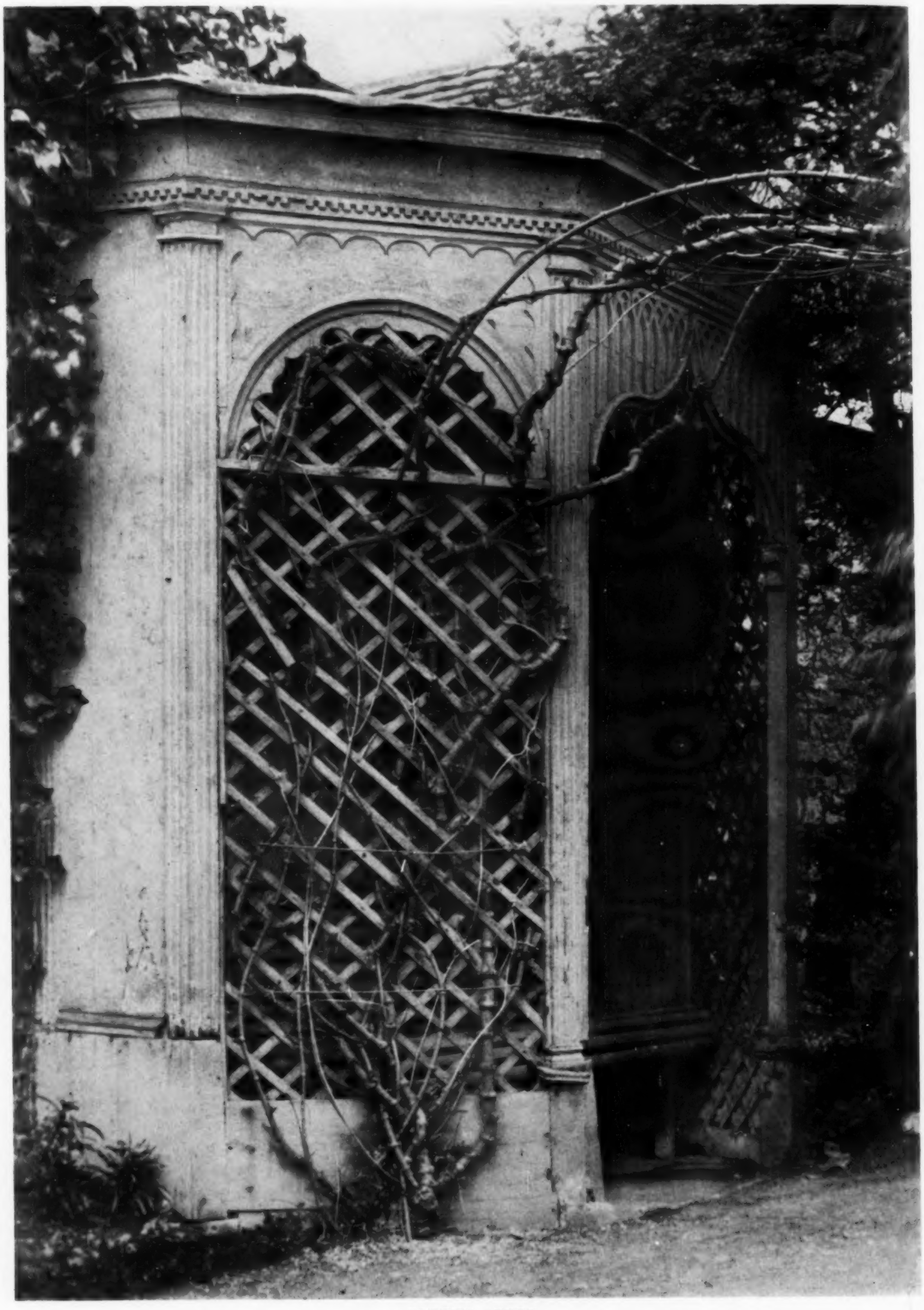

The Street Doorway
Upper Part of Bracket
Scale of Feet
0 1 2 3 4 5
TWICKENHAM HOUSE
Abingdon Berks



Plaster Cornice
Im-post (wood)
Dado (wood)
Skirting (wood)
Architrave
wall face
Detail of door
Section A B
Scale of Feet
Outside
Sill
Lines of ceiling
Dado
Skirting
Plan
A
B
Cupboard
Scale of feet for Plan
Detail of Sash
Inside
Details of the Octagonal Room at
· TWICKENHAM · HOVSE · ABINGDON · BERKS ·
Scale of inches for Details
MENS & DELT 1928


Section C.D.
Scale of feet
Section E.F.
Details of the Octagonal Room at
TWICKENHAM HOVSE ABINGDON BERKS
F. SCARLETT MENS et DELT 1928


Garden Arbour
Scale of Feet
Detail of Staircase
Scale-same as Arbour
Drawing Room
Hall
Clos
Study
Lav.
Carriage Court
Corridor
Dining Room
Living Room
Servants' Hall
Carriage Passage
Stable
Terrace
Kitchen
Larder
Scullery
Harness Room
Stable Court
Garage
Hens
Stores
Potting Shed
0 5 10 15 20 25
Scale for Plan
TWICKENHAM HOUSE
Abingdon Berks



GARDEN ARBOR
TWICKENHAM HOUSE, ABINGDON, BERKS.

GARDEN DOORWAY
TWICKENHAM HOUSE, ABINGDON, BERKS.

Garden Front

at large expense, even when gauged by later standards. Masterly craftsmanship was thoroughly appreciated, and not only desired but demanded. Enthusiasm for the best carving, paneling, decorative plasterwork, wrought iron and gauged brickwork, besides the finest masonry in brick and stone, meant expenditure with unstinted lavishness.

Twickenham House is a typical example of thoroughgoing eighteenth century renewal. So complete was the transformation it underwent that not a vestige of the house's former aspect was left visible. It is only when the walls and timbers are closely examined that the earlier structure comes into evidence. The outer walls, —street front, garden front and north side,— were encased in new brickwork after the best manner of the period; the interior was wholly refinished with equal pains, and every item, both in design and execution, is of the choicest quality. Everywhere, both inside and out, is the unmistakable impress of the eighteenth century. There is a tradition locally current that Inigo Jones designed Twickenham House but, if that great English Palladian ever had anything to do with it, all traces of his connection have vanished. The manner is that of many years after Jones was gathered to his fathers.

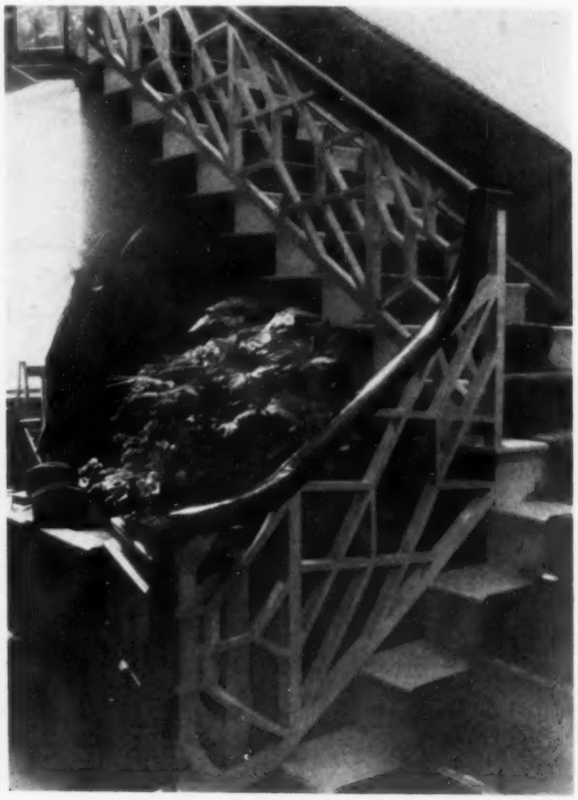
Unlike the majority of houses that were remodeled and refaced during the era of Georgian renewals, Twickenham House reveals plain evidence of having passed through several successive phases of alteration, although the greater part of the work indubitably belongs to the mid-eighteenth century. This fact does not in the least lessen the building's charm. On the contrary, all the features are so extremely good, and the items of different dates are so admirably blended, that the composite result gains a piquancy not always attaching to fabrics cast in their final form at one time. A somewhat unusual feature of the plan is the presence of two courts,—the outer or carriage court, and the inner or stable court. In the outer court is the old mounting block with a kennel for the watchdog beneath. Inside the house, various things happened during the process of reconstruction to bring the arrangement into conformity with the ordered regularity of Classic plan. The main body of the house is virtually square in plan, and on the ground floor there are the drawing room, dining room, living room, study, stair hall and corridors; the servants' hall, kitchen and domestic offices are in part of the north wing back of the carriage court. Above stairs the plan follows the same general scheme as below, the servants' quarters being in the upper story of the wing. The east front of the house fronts upon a terrace overlooking the garden which extends all the way down to the Thames; the stable court wall and the continuing greenhouses (not shown on the accompanying plan) give a shelter on the north and afford a "sun trap." The west or street front is of red

Stable Court

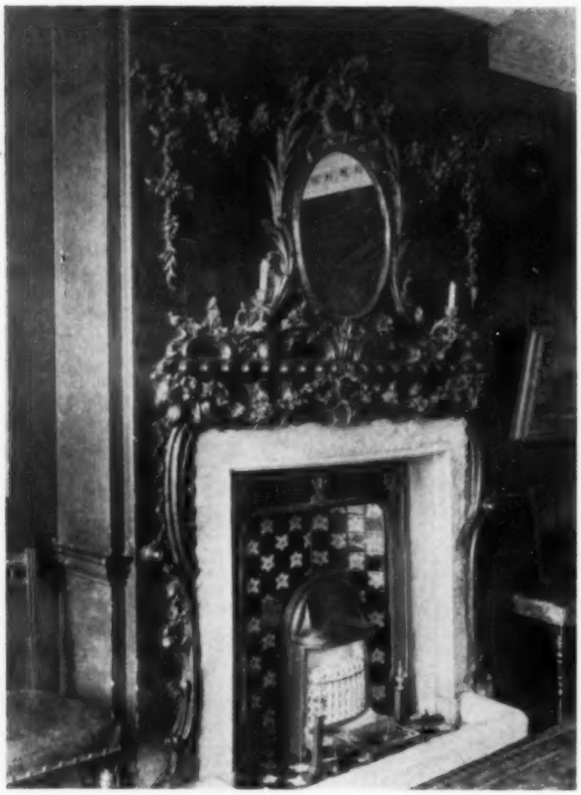
brick with limestone trimmings, and the splayed lintels above the windows are of rubbed brick. The cornice, be it noted, is of stone. Brick with a blue-gray, half-vitreous surface, once quite commonly used in the neighborhood, appears on the east or garden front, but the lintels above the windows and likewise the sides of the openings are defined with red brick, thus imparting a very agreeable color interest to the elevation. The roofs are covered with small red flat tiles.

An exceptionally pleasant feature of the garden elevation is the octagonal half-cupola, one side of which goes into the slope of the roof. This was obviously added at the close of the eighteenth century, as we may see by the evidence of the accompanying plates of drawings which show the exquisite refinement and delicate proportions of moulding profiles in vogue at that period. It was about the same time that the living room and dining room windows were cut down to the ground and fitted with two-leaved glass doors, in the French manner. It was also at this period that the windows of the south bedroom, above the dining room, were cut down to the floor and the iron balcony added outside them. In the dining room there is an exceptionally fine Rococo chimneypiece. The carving is elaborate and exquisitely wrought, but it will be seen that the proportions of the intricate details are somewhat more substantial than was ordinarily the case with contemporary work of this sort in France. Apart from the chimneypiece and excellent paneling, the dining room is further distinguished by its three door casings of two types, one of which is shown in the plates. The door casings in the hall, too, are of an unusually interesting type and in their design plainly show influence derived from a French precedent of the late seventeenth century. The top *motif* is strongly reminiscent of treatments employed by the great French architects of the Grand Monarch's time. The detail of these doorways in the hall appears in one of the plates that also shows the arcading on the south wall of the entrance and stair hall, on the opposite side from the staircase. One of the most engaging features of the interior is the little vaulted corridor of four bays leading from the back of the stair hall to the garden door and the terrace. It has all the grace and distinction attaching to its Italian Renaissance prototypes. The customary proportions, diminished to accord with the scale of the house, have lost none of their elegance of *ensemble* in the course of translation to fit a Georgian interior of modest size and character. It is another example of how English architecture has always profited by contact with Italian precedent, making it peculiarly its own and stamping it with a strongly national quality.

UPPER PART OF STAIRWAY

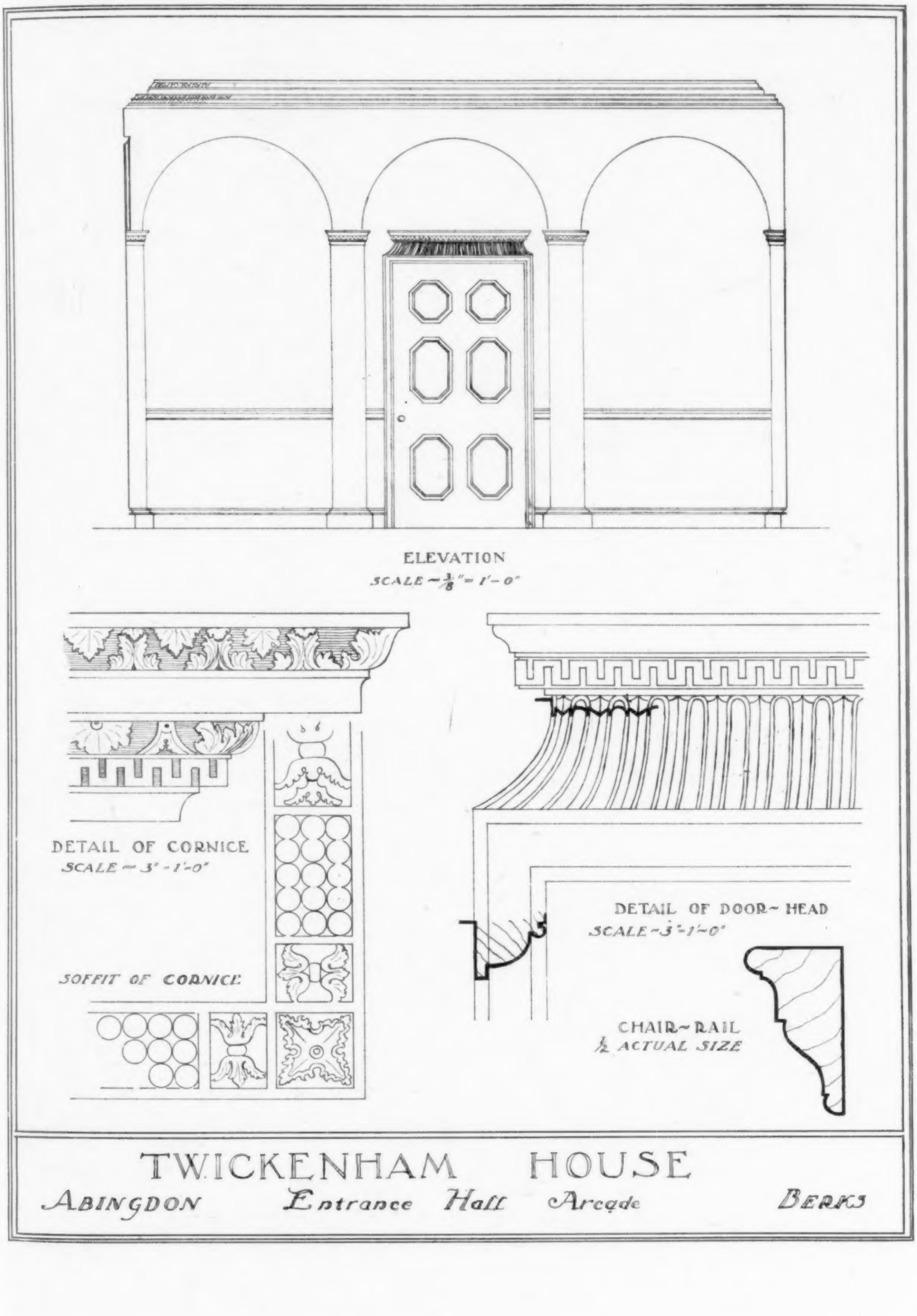


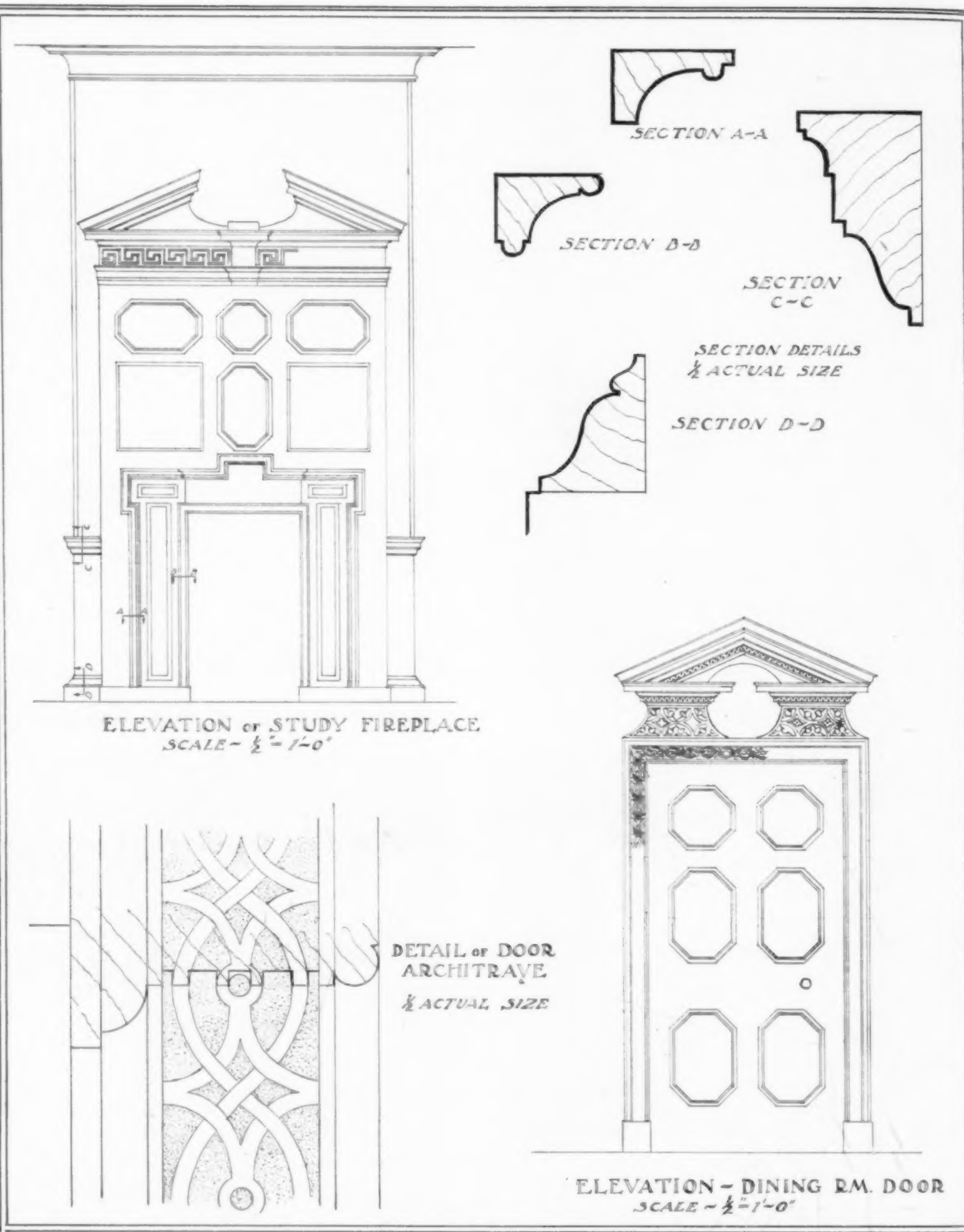
LOWER PART OF STAIRWAY



CHIMNEYPIECE IN DINING ROOM

CORRIDOR TO GARDEN TERRACE


ELEVATION
SCALE — 1/8" = 1'-0"
DETAIL OF CORNICE
SCALE — 3" - 1'-0"
SOFFIT OF CORNICE
DETAIL OF DOOR-HEAD
SCALE - 3" - 1'-0"
CHAIR-RAIL
1/2 ACTUAL SIZE
TWICKENHAM HOUSE
ABINGDON Entrance Hall Arcade BERKS



TWICKENHAM HOUSE ~ ABINGDON ~ BERKS
FIREPLACE IN STUDY AND DINING ROOM DOOR ~

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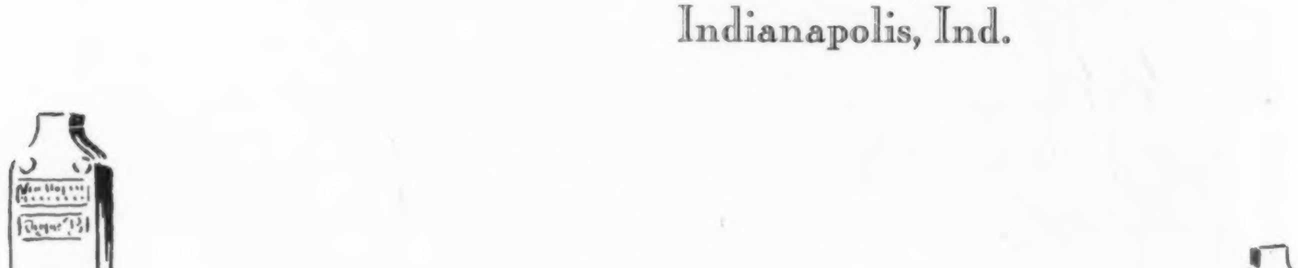
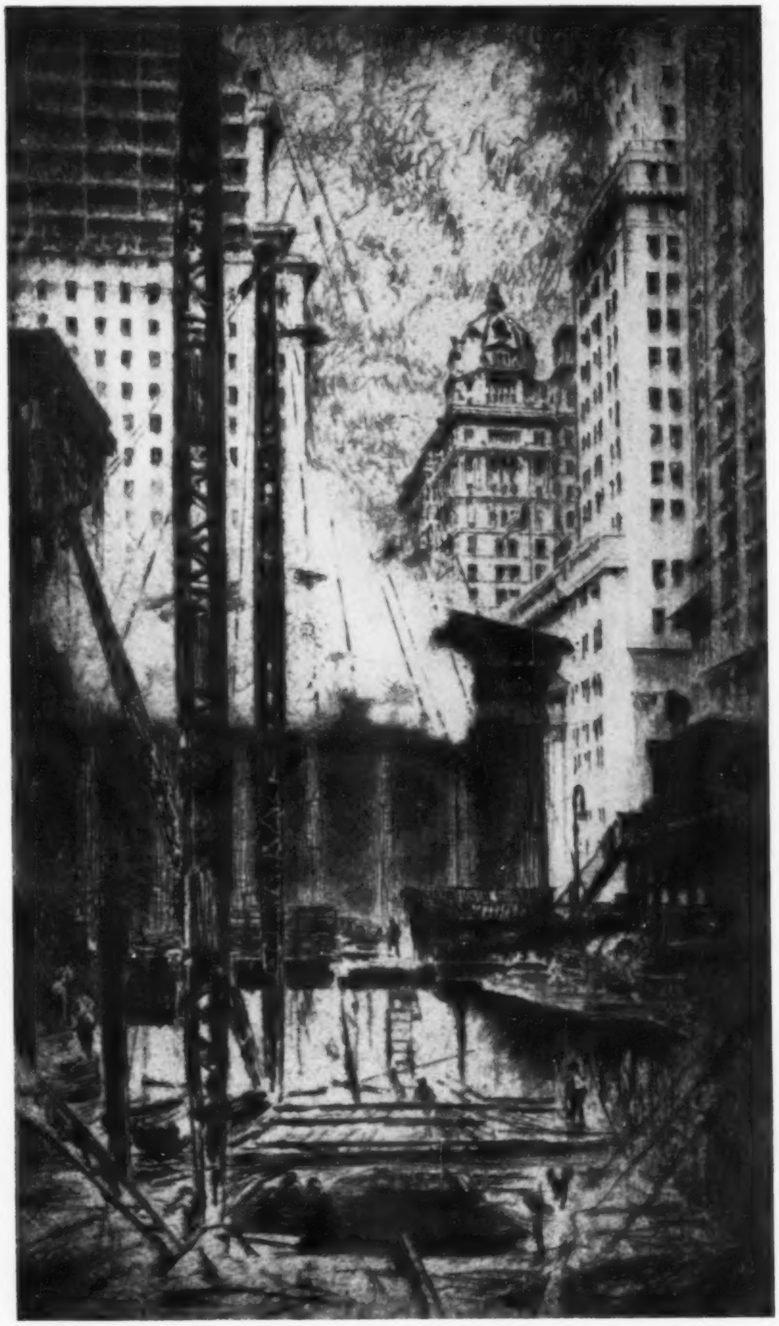




EXCAVATION

THE CHASE NATIONAL BANK, NEW YORK

GRAHAM, ANDERSON, PROBST & WHITE, ARCHITECTS

From an Etching by Karl Dehmann

THE
ARCHITECTURAL
FORUM

VOLUME L

NUMBER FIVE

MAY, 1929

CHOOSING STRUCTURAL SYSTEMS AND MATERIALS

PART II—EXTERIOR WALLS AND WATERPROOFING

BY

THEODORE CRANE

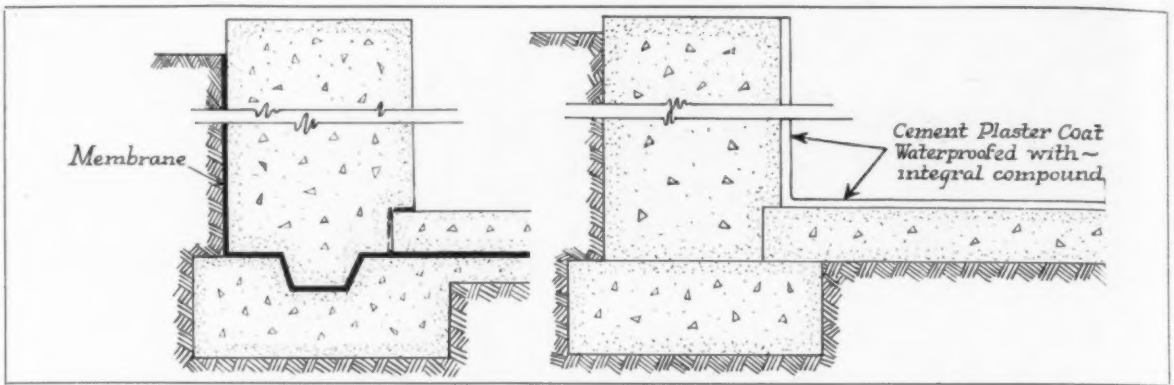
ASSOCIATE PROFESSOR OF BUILDING CONSTRUCTION, YALE UNIVERSITY

SINCE the earliest days, walls have served mankind as enclosures for the purpose of protection. Many and various methods have been used, depending upon the material available and the skill of the builders. In ancient and mediæval times the stone walls of isolated residences, three or four stories in height, were often of masonry 6 or 8 feet in thickness. Such were not necessary as supports for floors or roofs, but every foot added a definite increment to the time required by an enemy to effect a breach. Through long ages military considerations played a large part in the construction of most important structures, even within the limits of walled cities, and military motifs, such as crenelations and machicolations, still appear in the architecture of today.

With the development of modern artillery and the resulting futility of offering even massive masonry as a target for heavy ordnance, military necessity, of course, ceased to exert an influence on construction. In modern buildings, the utilitarian purpose of walls is to support incumbent loads, resist the inclemency of the weather, and give a certain amount of privacy to those within. Artistically, their exterior and interior finishes, thicknesses and disposition, must meet the architectural demands. It is not mere banality to rehearse these all too obvious requirements. In our search for combinations of materials, the use of which will effect the greatest economy, these simple, basic principles are often lost to view in the mist produced by modern advertising and high powered salesmanship. That our present methods of construction are a complete success, few would have the temerity to affirm. It would seem desirable to advance step by step in our consideration of anything as important as wall construction. It is not easy, for instance, to make tall buildings water-tight against wind-driven rain. Some of the most important structures in New York have caused no end of trouble, simply because their walls do not serve the basic requirement of being satisfactory enclosures. The pity of it is that these conditions are preventable; even with the limitations of our present knowledge, the profession knows how to build tight walls, and workmen properly supervised are capable of doing it.

Proportioning Footings. Let us first consider the requirements of stability or structural strength and commence at the bottom or foundation of the wall. Structures may rest upon rock, soil, or piles. The choice of footings for the support of piers or columns was referred to in the April issue of THE ARCHITECTURAL FORUM. Bearing walls and load-carrying partitions occur principally in buildings of only a few stories in height, and the footings are usually built of concrete with sufficient width to bring the load per square foot within the permissible bearing value of the soil. This would be a very simple matter were it not for the fact that most soils are compressible when subject to even moderate loads, well within the limits of ordinary practice. This fact makes it necessary to widen footings under piers and chimneys, or other masses of masonry, and to make proportionment of footing areas on the basis of dead load alone, or in combination with a small portion of the live load. This matter receives careful attention on the part of the engineer when he is employed to design important structures, and it should not be passed over too lightly by the architect if he would have his buildings settle evenly and avoid unsightly cracks.

To illustrate the application of this principle, consider the case of a three-story-and-basement school building with exterior bearing walls and interior columns supporting any type of fire-resistant floor system. Under most building ordi-



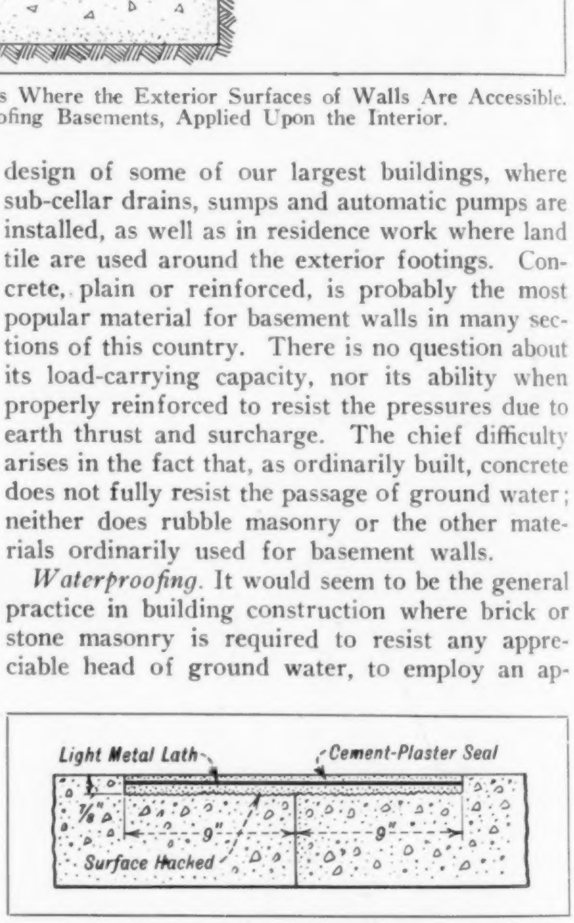
Left: The Membrane Method of Waterproofing Basements Where the Exterior Surfaces of Walls Are Accessible. *Right:* The Plaster-Coat Method of Waterproofing Basements, Applied Upon the Interior.

nances the classrooms would be designed to support a live load of 75 pounds per square foot. Published investigations by the Building Code Committee of the Department of Commerce lead us to believe that normal occupancy would result in an actual live load, including pupils and desks, of between 10 and 14 pounds per square foot. The *constant* and not the *occasional* loads are those that cause settlement. It is also true that the proportion of live load to dead load is much higher for the interior supports, such as columns, than for the exterior walls. If we design our footings for the entire live and dead load, *without other proportionment,* the interior footings will exert a much lighter soil pressure, owing to the fact that 60 or perhaps 65 pounds per square foot of live load are non-existent. In order to avoid the possibility of the exterior walls' settling more than the interior of the building, it is not only necessary to design the footings of adequate sizes to carry, with the allowable soil pressure, the *full design load* of the buildings, but also to proportion them, as in this case, on the basis of the dead load alone.

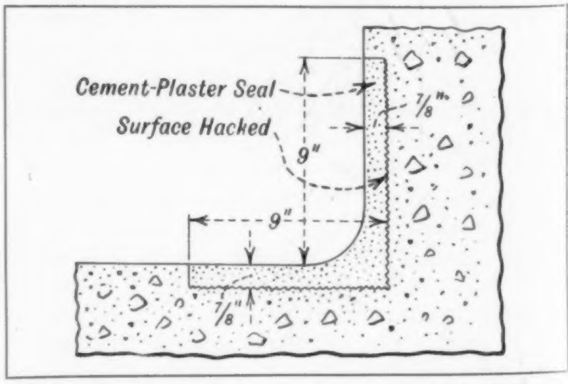
Foundations resting upon piles present a condition entirely analogous to soil-bearing footings. Piles may be driven to refusal, or their sustaining power may be due to "skin friction." In the latter case they will probably be subject to greater settlement than if their ends reach an impervious stratum. The most critical condition is where a portion of a building rests on rock, or other unyielding material, and the remainder of the structure is supported by a compressible soil or piles subject to settlement.

As the function of basement walls is purely structural, use should be made of the cheapest material that will give support and impermeability. The latter requisite, as applied to masonry, is a somewhat relative expression, and it is often economical to accept a system of drainage in lieu of absolute water-tightness in basement construction. This principle is acknowledged in the design of some of our largest buildings, where sub-cellar drains, sumps and automatic pumps are installed, as well as in residence work where land tile are used around the exterior footings. Concrete, plain or reinforced, is probably the most popular material for basement walls in many sections of this country. There is no question about its load-carrying capacity, nor its ability when properly reinforced to resist the pressures due to earth thrust and surcharge. The chief difficulty arises in the fact that, as ordinarily built, concrete does not fully resist the passage of ground water; neither does rubble masonry or the other materials ordinarily used for basement walls.

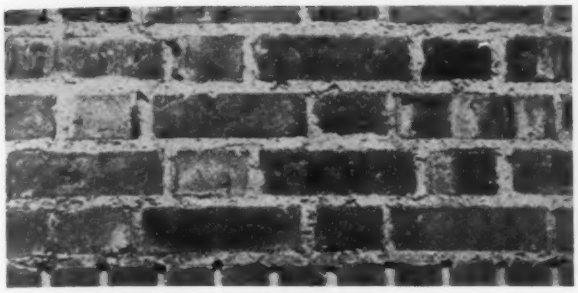
Waterproofing. It would seem to be the general practice in building construction where brick or stone masonry is required to resist any appreciable head of ground water, to employ an ap-



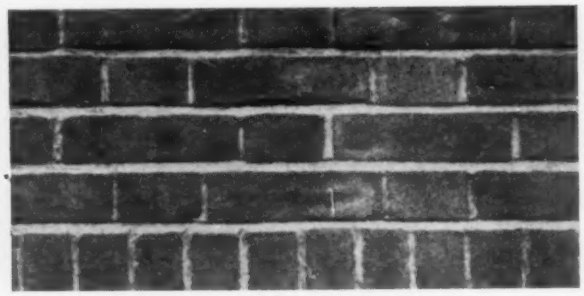
Cement Seal at Joint in Integral Waterproofing



Method of Reinforcing a Construction Joint Between Floor and Wall in Integral Waterproofing



Rough Flush Joints, of Coarse, Dry Mortar Cannot Be Expected to Be Rain-tight in Exposed Locations

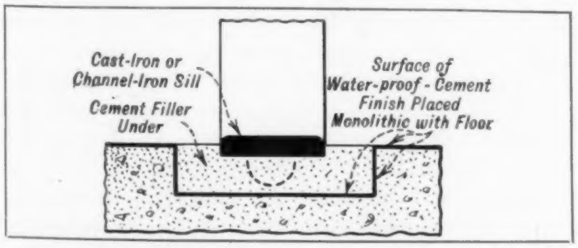


A Well Compressed, Weathered Joint Helps Make Walls Tight Against Wind-driven Rain

plied waterproofing. Such is usually of the membrane or of the "cement-coat" variety, although certain methods employing bituminous compounds are occasionally used without a membrane, and the so-called "iron process," referred to later, may be applied to brick walls. Owing to the fact that concrete is manufactured on the site, it is possible, in the case of this material, to use integral compounds. This fact has been the genesis of a great and widely advertised industry. There does not seem to be any valid objection to the use of accredited admixtures in concrete work, and in fact many of them have a distinct value for waterproofing purposes. The unfortunate part of the situation is that emphasis has too often been laid upon the use of proprietary compounds instead of upon good workmanship. Good concrete is reasonably impermeable to water, but poor concrete cannot be made so by the use of any admixture yet placed upon the market.

The subject of waterproofing concrete walls has received a great deal of attention during recent years. Broadly speaking, the various systems at present in general use are:—

1. The membrane method, employing layers of felt, jute or cotton drill laid in pitch or asphalt, or some composition of bituminous materials.



Cement Waterproofing Under a Metal Door Sill

Cement Waterproofing Back of a Metal Door Jamb

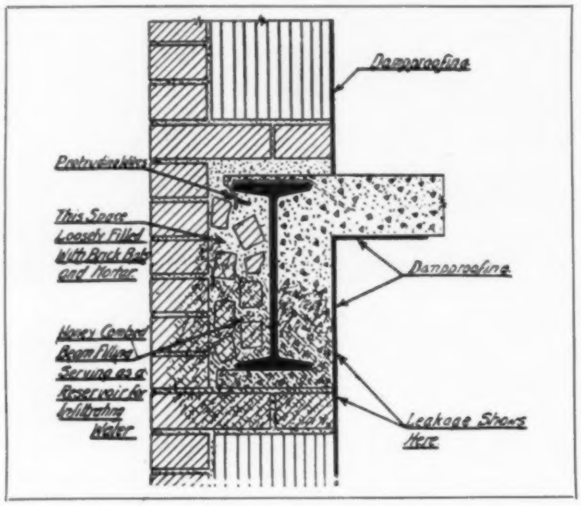
2. The "plaster-coat" method, being the application of two coats of cement mortar, containing a waterproofing compound, to face of wall. The total thickness is normally ⅝ to ¾ of an inch.

3. Integral compounds, which are added as dry ingredients to the cement, or as liquids to the mixing water, for the purpose of making the concrete itself more impermeable.

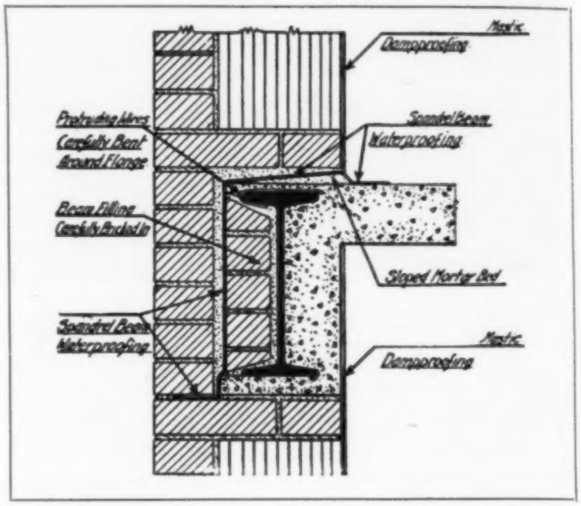
4. Various spray, brush, mop and trowel applications to walls below grade, generally employed where no hydrostatic pressure exists.

The problem of choosing the best type of waterproofing is so dependent upon the particular conditions of the particular work that it is extremely difficult to give any general rules. The membrane method, employing a good quality impregnated fabric with an elastic binder, can be successfully used against high pressures, but the cost is often very high. For comparatively shallow basements, the membrane can be applied to the exterior, but when the outside of the building below grade is inaccessible, the cost of interior application, with the accompanying seal, makes the operation proportionately more expensive. Some of the largest buildings in New York have exterior walls sunk by the caisson method, 50 to 70 feet below ground-water level. On such operations the so-called "plaster-coat" method, applied to the interior of the wall surfaces and to the cellar floor, has been successfully used. It should be remembered, however, that the concrete walls are often 6 or 8 feet in thickness, and that a system of drainage is usually installed below the cellar floor, connected to a central sump and relieved by automatic pumps. Furthermore, the mortar is carefully prepared with Portland cement mixed with a well graded sand and an effective waterproofing compound. The success of such work done by trained mechanics, under expert supervision, is no reason to accept this method where technical skill is unavailable.

The principle of waterproofing the concrete composing the wall, instead of applying surface applications, has very interesting possibilities, but under the conditions ordinarily encountered in building construction, it requires the greatest care



A Typical Spandrel-Beam Construction That Frequently Causes Leakage



A Typical Spandrel-Beam Construction Showing a Recommended Method of Flashing

if the work is intended to withstand any appreciable head of water. The concrete should be composed of well graded aggregates proportioned for maximum density. The mixture should be thoroughly homogeneous and as dry as may be consistent with perfect "workability." Some waterproofing preparations add to the plasticity of the mixture, thereby lessening the amount of water required for placement, which results in a stronger and more impermeable concrete. It is also claimed that the addition of certain compounds causes a more complete hydration of the cement. The use of calcium or ammonium stearate, which is the active ingredient of numerous waterproofing compounds, has been found to greatly reduce the capillarity of mortars, but this effect is of much greater comparative value against wind-driven rain above grade than against hydrostatic pressure below ground. Another method of integral waterproofing consists of introducing 2 or 3 per cent of inert material for the purpose of filling the voids of the concrete. The object is excellent, but unfortunately the air and water voids in the completed mass, which do affect permeability, cannot be so easily filled.

The whole subject of integral compounds has given rise to so much acrimonious discussion that it is a very delicate field upon which to trespass. The proposed building regulations promulgated by the American Concrete Institute have very consistently avoided any reference to the subject, from the first "Standard Building Regulations" published in the "Proceedings" of 1917, to the tentative "Joint Code" published in 1928. It is not the function of a building code to control decisions in regard to methods of waterproofing. The various "Joint Committees" on specifications, however, have taken a real interest in the subject. In 1926 the "Final Report" of the old Joint Committee could hardly be said to encourage the use of integral compounds; in 1921 the "Progress Report" of the new "Joint Committee" said that "Integral compounds shall not be used"; the "Final Report" in 1924 contained the specification that "Integral compounds shall not be used for waterproofing unless specifically authorized by the Engineer." This committee represented four of the leading professional societies, and there was no higher authority in the field at that time. On the other hand, we have a record of excellent results obtained by the better grade of waterproofing compounds, where they have not been expected to do the impossible and have been used with a just appreciation of their limitations.

When employing this method of waterproofing basements against actual pressure, it is essential that the floors and walls be properly keyed together, that laitance and honeycomb be eliminated, and that complete homogeneity as well as a tight, interlocking bond be obtained between the concrete comprising sections poured at different times, such as that placed on successive days. The fact that these conditions are extremely difficult to obtain, is adequate reason for reserving this system of waterproofing for work executed under the strictest supervision.

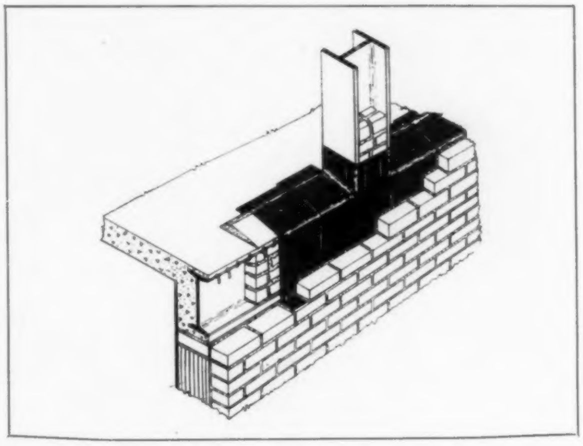
Brush and spray applications should generally be considered more in the nature of dampproofing than waterproofing treatments. However, there are at present materials falling under this classification, such as an emulsified asphalt, which seems to be satisfactory against a considerable head. Furthermore, the "iron process," which consists in applying three or more coats of iron dust, mixed to a cream with water combined with varying amounts of Portland cement, has been used successfully on basement walls where comparatively little pressure existed. Nevertheless,

the chief value of these preparations is for dampproofing basement walls and as surface coatings above grade, to reduce the permeability of masonry. Of course, only the colorless compounds can be used on the exteriors of buildings, but the bituminous compounds are usually to be recommended on other than exposed surfaces.

Masonry Walls. Omitting special types of construction peculiar to certain localities, exterior masonry walls above grade are usually built of brick, stone, concrete, load-bearing terra cotta, or cement block. All of these materials have sufficient structural strength, and when built into masonry walls of the thickness called for by good practice and code requirements, they furnish adequate support to carry imposed loads. In other words, if the exterior finish of the building is to be brick, either terra cotta, "back-up tile" or common brick can be used for the body of the masonry wall. In most climates an air space is necessary to avoid condensation, so if solid brick is used the wall should be furred, preferably with terra cotta. The requirements of appearance, structural strength and insulation will then be satisfied, but it remains to make the wall rain-tight.

Brick is one of our oldest manufactured articles. Its origin as a structural material is lost in antiquity, many thousand years ago, but it is not a uniform product. Architecturally, this is an immense advantage, permitting a pleasing variation in texture and color of wall surfaces. Structurally, it implies the necessity for accurate specification in order to obtain the best results. Most bricks are sufficiently impermeable to shed water on vertical surfaces. Standard requirements eliminate the soft "salmon" bricks or those that fall below a minimum compression strength, and often they place a maximum limit upon the absorption of about 15 per cent by weight. But it is not customary to place a *minimum* requirement upon the absorption, nor to specify a low limit on the modulus of rupture. Face brick, similar to those used recently for a building in southern New England, give an absorption of less than 2 per cent. The walls constructed of these units showed a lack of bond between brick and joint, which was a contributary cause of serious leakage.

Weatherproof Brick Walls. It is probably true that most of the trouble from leaky walls is not due to the quality of the materials, but to the faults of execution, and it occurs principally at floor levels in skeleton buildings, along parapets, and around openings. It would appear, however, that care should be exercised in the choice of brick for exterior use in exposed locations, and preference placed upon those which have enough absorption to draw the mortar into the pores, without being sufficiently porous to become water-soaked during hard, driving rains. Furthermore,



Spandrel-Beam Waterproofing

the specification for thoroughly "wetting all brick immediately before laying" is one that should be considered in the light of the characteristics of the particular brick to be used, and not as a standard clause. Neither should brick be laid in weather even *approaching* the freezing point without due precaution. The technology of brickwork is a subject which merits, and is at present receiving, very serious consideration. It is to be hoped that the building departments of our municipalities will, in the near future, avail themselves of the information offered by our scientific committees and manufacturers' associations. To specify a limiting value for the compressive strength of brick probably results in eliminating very soft, underburned material, but this requirement is only remotely related to the strength of the wall which the specification is supposed to safeguard, as failure seems to result from the *breaking* of the brick and not from their *crushing*. As there is not a definite relation between these two types of stress, it would seem desirable to specify a minimum value for the modulus of rupture.

The character of the joints, as well as the bond between mortar and brick, plays an important part in making walls rain-tight. With all due respect to architectural considerations, thick joints of coarse, dry mortar should be avoided in exposed locations. The raking out of joints is only a little more harmful than the ordinary method of "striking" a flush joint by which the mortar is torn by the trowel and often actually drawn away from the side of the brick. A vast amount of trouble within the last few years, particularly on the tall buildings in New York and Philadelphia and hotels at Atlantic City, has proved that the proper construction of the joints is of vital importance. It is desirable to point the joints with the same mortar that was used in laying the wall, as a richer mixture gives greater contraction on setting. A waterproofing compound such as ammonium stearate, which has been definitely proved

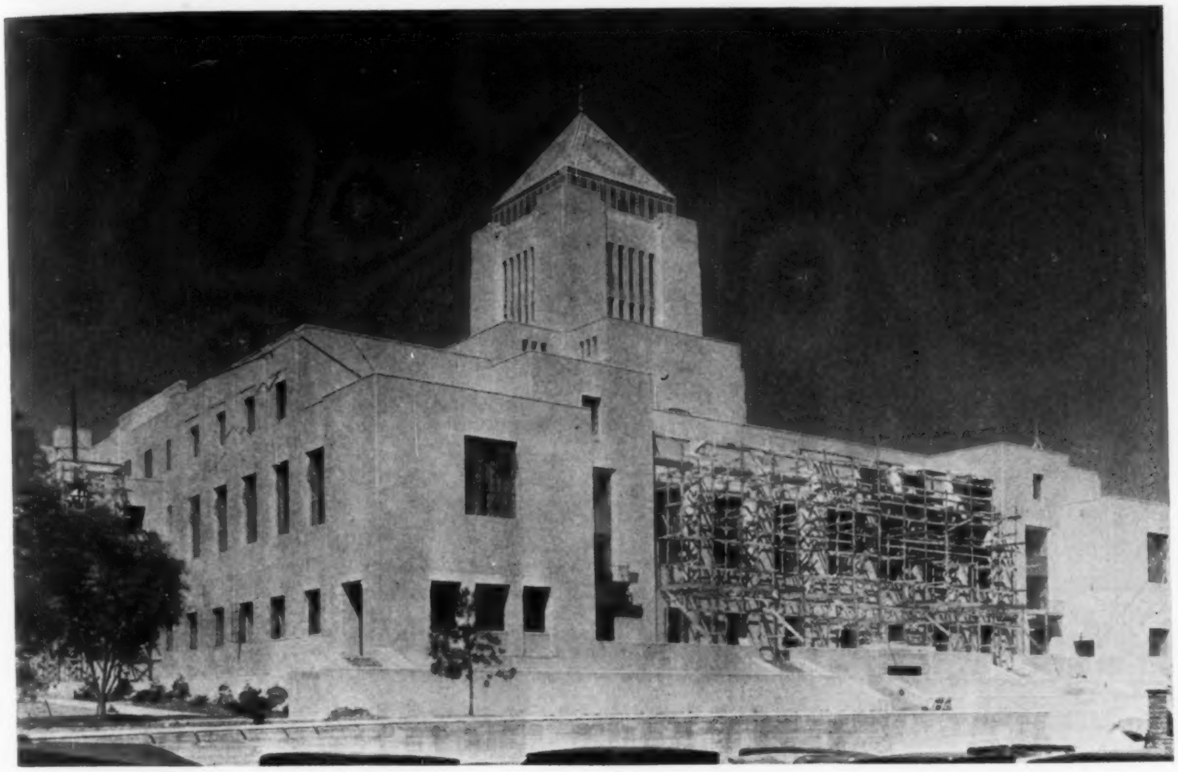
Los Angeles Public Library, Under Construction, Showing the Use of Poured Concrete for Exterior Walls
Bertram Grosvenor Goodhue, Architect. Carleton Monroe Winslow, Associated

to reduce capillarity, is strongly recommended. The correct amount is about 2 per cent by weight of the cement. A normal, cement-sand-lime mixture should be used, but the sand should be carefully chosen as clean, not too fine, and well graded. In the operations of pointing, particular care should be exercised to thoroughly compact the mortar; a so-called "rodded" joint or a well pressed "weathered" joint is to be preferred.

The choice of the bond is not an important matter from a structural viewpoint, as all standard bonds give adequate strength. If 8-inch walls are used, it is necessary to thoroughly bed the through headers, and two coats of bituminous dampproofing on the interior give excellent insurance, although inadequate to overcome any serious defects such as settlement. Fortunately, 12-inch walls are required for all important buildings, and the longitudinal mortar joint should serve as a water break.

The design of details, as well as the quality of the work, should be given serious consideration if exterior masonry walls are to be made tight against wind-driven rain. It is very important that drips be provided on all projecting or capping members, such as parapet copings and window sills. Stone sills with lugs are less likely to leak than those of the "slip sill" pattern. The upper surfaces of masonry units should also have a pronounced slope or wash. It should hardly be necessary to say that flashings must be properly designed and gutters and leaders be of adequate proportions, yet much trouble is due to the neglect of these items. Particularly troublesome is the leakage through vertical joints in brick sills and parapets. These should be pointed with mortar containing a water-repellent, such as ammonium stearate, and flashed entirely across the wall with copper or with a high grade membrane, as the latter is quite effective and much easier to use. The backs of parapets should also be flashed with metal or membrane and not merely painted with a "black waterproofing." A great deal of serious leakage results from poorly designed parapets, and even if water is prevented from entering the building by flashings carried across the wall at the roof level, efflorescence may appear upon the exterior unless the *inside* is rendered impermeable.

Elastic cement should not be counted upon to make tight the vertical joints between natural or artificial stone, employed for cornices and copings, except when it is impracticable to flash. In most cases a metal or membrane flashing can be installed as illustrated by the standard construction employed for cornice work. If this is not feasible, a high grade elastic compound should be chosen that will not stain the stone nor quickly decompose under climatic variations. It is ques-



The Los Angeles Public Library, Nearing Completion, Showing the Architectural Effect Obtained
Bertram Grosvenor Goodhue, Architect. Carleton Monroe Winslow, Associated

tionable, however, if any material on the market will permanently close vertical joints on exposed work. The principal use of elastic cement, or more properly of caulking compounds, is to make weather-tight joints around openings. Wood frames in masonry walls should be packed with oakum on top of which a beat of elastic cement can be run beneath the staff bead. The same material is used to advantage in making tight the junction between the wood sill and the supporting masonry. A similar process, without the use of oakum, can be successfully applied to the setting of steel or hollow metal frames in masonry walls.

Waterproofing Spandrel Beams. One of the most frequent sources of trouble on structural steel buildings, is lack of proper flashing at spandrel beams. The typical "cinder arch" floor construction, so widely used in parts of the East, often results in providing practically no resistance to wind-driven rain other than a 4-inch brick or stone veneer. As this condition occurs at all floor levels, it is hardly any wonder that a large number of our tallest buildings have developed serious leaks. This situation has lately received considerable study on the part of some of our best builders, assisted by waterproofing engineers. On new work of the better class a membrane is employed, often backed up by a trowel coat of mastic. It is first necessary to fill with brick the space between the flanges of the beam, bending the ends of the floor slab reinforcement out of the way. A bed of cement mortar is then laid on top of the floor arch, along its outside edge, to form a base for the waterproofing. The membrane and mastic are applied, as shown in the sketch, included here, when the brickwork of the veneer has reached the first course below the bottom flange of the spandrel beam and is built into the masonry, continuing over the top of the floor arch a distance of 3 or 4 inches beyond the inside face of the wall. The membrane is placed on three sides of ordinary wall columns and upon all four sides of corner columns. These precautions apply to stone as well as to brick veneer.

Efflorescence. The problem of making exterior walls rain-tight is closely associated with that of efflorescence. Soluble salts are always present in varying amounts in cement, brick and terra cotta; if such come in contact with moisture, by reason of inadequate flashing or leaky joints, they are likely to be carried in solution to the face of the masonry and there deposited as white coatings which not only disfigure the wall, but actually exfoliate the surface. Efflorescence consists of various compounds, principally sulphates and chlorides of sodium, potassium, calcium and magnesium. Because the formation of minute crystals takes place under the surface, as well as upon the face of the wall, serious scaling often results.

Some excellent research work has lately been

The Biology Building, California Institute of Technology, Illustrates a Design Particularly Suited to Reinforced Concrete. The Wall Surfaces Were Later Stuccoed
Mayers, Murray and Phillip, Architects

devoted to the investigation of these phenomena, from which it is possible to make definite recommendations to eliminate, or at least to materially lessen, this evil. In the first place, the design should provide for thorough flashing and require adequate drips on all projecting members. Fine buildings should have a highly impermeable course such as granite, at the ground level, and every type of masonry structure should be provided with a layer of membrane with mastic separating foundation from superstructure, to prevent water being drawn up from the basement walls by capillary action. Natural stone veneer should be laid in mortar made with a non-staining cement, preferably waterproofed with calcium or ammonium stearate. The unexposed surfaces of the stone can best be protected by a heavy parging of the same mortar that is used for setting. If a coat of "black dampproofing" is preferred to the use of mortar, it is recommended that the material selected be given a thorough investigation, as some preparations offer but little resistance to the action of either sodium, magnesium or calcium sulphate.

Although it is not customary to lay brick veneer in a mortar containing non-staining cement, this would appear at times to be a very sensible procedure, as much of the efflorescence on brick walls seems to come from the cement. Both the ordinary Portlands and the other cements, now quite widely used in brick-setting mortars, contain soluble salts capable, in the presence of water, of producing discoloration. Having decided upon the materials to be used, the precautions to be taken against efflorescence are exactly the same as those required to make exterior walls raintight, with the added suggestion that while it is imperative to keep water from getting *into the wall,* it is extremely desirable to minimize the amount of water *flowing down the exterior.* It should not be inferred, however, that all efflorescence comes from the mortar. In some parts of the country, notably in southern Connecticut, common brick cause their full share of trouble, and it would seem to be a case of the pot calling the kettle black. The use of colorless applications for waterproofing purposes upon the exposed surfaces of stone or brick walls, is not always entirely efficacious. It is so difficult to completely seal a surface, even with the best of workmanship, that air and moisture will usually penetrate. Neither are the various proprietary washes advocated for the removal of efflorescence to be considered as universally permanently effective. It is quite a simple matter to clean the walls, but the white salts will soon re-form if the cause is not removed. There has been more or less discussion lately about the desirability of mixing barium compounds in the clay of which certain common brick are formed, for the purpose of reducing efflorescence by changing the sulphates into insoluble precipitates. This principle has been successfully applied both in the ceramic and the face brick industry; it would seem to be equally applicable to common brick.

There are very few builders who do not realize the importance of properly protecting both natural and artificial stone before and during construction. Brick should also be piled on plank and protected from snow and rain. Particularly

Residence Before Application of Stone Veneer
C. E. Reichle Co., Designers

The Same Building Veneered in Limestone Finished in Old Gothic. Random Ashlar

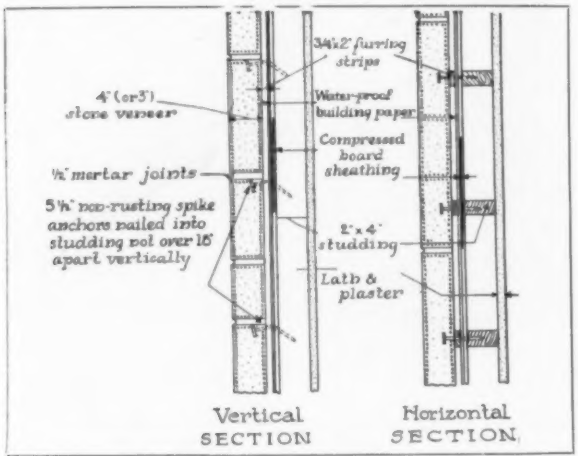
essential is some effective method of covering the tops of incompleted walls which must remain for some time exposed to the elements. During even a few days' exposure to heavy rains they may entrap sufficient water to cause discoloration of the surface of the wall long after the completion of the work. Serious efflorescence has also resulted from the seepage of rain water through a con-concrete roof slab, left for several months without a protecting membrane. In this case a limestone cornice was badly disfigured by the precipitation of salts dissolved from the concrete.

Concrete, Cement Bricks and Blocks. For over a generation now, while the more conventionally minded have been building walls of stone and brick and terra cotta, engineers have been experimenting with monolithic concrete. About 20 years ago this type of construction was applied to a number of dwellings ranging from large residences to very small houses; since then the public has quite often been aroused by the thought of obtaining "poured" houses at a fraction of the cost of building them. In the east, these ideas have never materialized on a large scale; the cost of the wood forms, the impracticability of using steel forms for other than standardized work, and the mechanical difficulties of handling comparatively small operations economically, have all counted in the score against building walls of poured concrete. On large operations, however, where local conditions are favorable, concrete walls may be cheaper than brick, and we are all familiar with their use for industrial buildings, where an efficient plant has already been installed for the concrete of the frame and floor constructic Again, it is extremely hard to generalize. Th architectural characteristics of concrete are so well suited to certain types of architecture, particularly the so-called "Spanish" style of our southwest, that this advantage alone may dictate its choice.

Cement blocks have been used in building construction since Civil War days; units removed lately from an old building showed a compression strength which would meet present-day specifications, although probably made from a natural cement. The average plant of today is turning out a product conforming to the requirements of the American Concrete Institute. Nevertheless, it is extremely important to make certain that the blocks are cured in such a way as to avoid, or rather to minimize, volumetric changes after incorporation in the building. At present it is not apparent that curing methods are standardized or at all times adequate, and if cracks are to be avoided, it is of vital importance that only thoroughly cured units be used.

Although the Portland Cement Association has laid down a conservative policy in regard to furring walls built of hollow cement units, it is regrettable that contractors will take the chance of plastering directly on the inside of the block. As in the case of terra cotta walls built of a single thickness of hollow tile, such construction may be successful, but it cannot be considered good practice. If properly designed, both terra cotta and cement block serve excellently as bases for stucco. The former is, at the present time, a somewhat more uniform product and not subject to as large volumetric changes. On the other hand, the bond between cement block, as ordinarily manufactured, and the base coat of stucco is excellent, while the tile surfaces depend largely upon the scoring for bonding. Besides these units that have been used for over a period of years, cement brick and cement cinder block have a wide field as "back up" material in the rear of brick or stone veneer, and the cement cinder block is particularly suitable under stucco.

Stucco. The use of stucco as an exterior wall finish in northern climates is a subject that merits serious consideration. Portland cement stucco can be applied successfully to brick, stone, cement block, terra cotta, wire mesh or wood lath. Some years ago wood lath ceased to be used for this purpose in many parts of the east, but excellent work in northern sections of the middle west definitely proves the possibility of obtaining good results with this construction. Metal reinforcement was, at one time, considered to fail by rea-



Details Illustrating the Assembly of Stone Veneer Over a Wood Frame

son of rusting when used along the sea coast, but it has been found that such failures can be attributed to poor workmanship, as a dense mortar will adequately protect the reinforcement if the latter is properly placed.

Over frame construction, good practice would require a rather large meshed metal fabric held free of the sheathing by means of furring nails or other means which permit the stucco of the base coat to pass back of and to thoroughly embed the steel. The requirements covering materials and method of application are well defined by the excellent specifications furnished by the Portland Cement Association, which should be scrupulously followed. No one, however, can guarantee success if the work is done over a wooden frame that will shrink appreciably after the stucco is in place. Every precaution should be exercised to obtain well seasoned lumber and to permit the building to dry out as much as possible before the final coat of stucco is applied.

In this country comparatively little stucco is used over brick or stone: when these materials are employed, they are generally desired for their architectural as well as their structural value. Occasionally we see a brick chimney over which stucco has been applied, but it is almost impossible to avoid there being cracks due to temperature variations, which soon result in failure of the surface. Stucco over terra cotta or cement block is a thoroughly established method of construction. With proper care there is no reason why it should not be entirely successful. The partial failures, which are only too evident throughout the country, can be definitely attributed to improper specifications or to poor workmanship. Again, the data available in the publications of the Portland Cement Association can be taken as authoritative. In matters of design the limitations of the material, or rather its structural characteristics, should be clearly understood; particularly important is the avoidance of using stucco on other than vertical surfaces. For example, the tops of ornamental parapets, sills and belt courses are often a source of trouble. Chimneys above roofs should be built of brick or stone, without any surfacing, wherever the architectural design will permit such a treatment. If stucco is required, it should be carried upon wire fabric, placed so as to provide an air space between it and the block or tile composing the chimney. The flashings should receive particular attention, as it is of vital importance to keep water from penetrating in back of stucco. Particularly critical are the sections where masonry joins a superstructure of wood, which sometimes occurs on dormers in residence construction. In such places wire fabric should lap the masonry at least 12 inches, or more if necessary to secure firm nailing into the joints. Stucco panels in half-timbered construction should be flashed at the top, if exposed, and always at the bottom; a rabbet 5/8 inch wide and the depth of the base coats, should suffice on the vertical joints between wood and stucco. Brick veneer over a wooden frame is quite popular in parts of the south, and the method of construction is too well known to warrant description. In some sections of the country stone veneer, 3 or 4 inches thick, is used in much the same manner. Where the cost of masonry is relatively high, a stone exterior can thus be obtained at a price considerably less than that of solid walls.

The use of insulating materials to reduce the heat loss from buildings, particularly those of wood construction, has recently been given much publicity. From the research work of certain progressive companies we have been made appallingly aware of the great heat losses through ordinary types of construction. It should be remembered that the actual loss through the walls of even a frame structure, is only about 25 per cent of the entire heat loss of the building. Approximately 75 per cent of such so-called "waste" occurs through glass areas, around openings, under eaves and through attic floors or roofs. In other words, the application of some proprietary system of insulation to the exterior walls of a country residence, from sill to plate, might be expected to reduce by 5 or 6 per cent the number of heat units required to heat the interior of a moderately well constructed house.

The next article of this series will treat of floor and roof construction.

NOTE. *The author wishes to acknowledge his indebtedness to these firms and associations for their assistance in the preparation of this article: American Face Brick Association; Indiana Limestone Company; A. C. Horn Sales Corporation; Structural Waterproofing Company; and Toch Brothers.*

SOLVING THE ELEVATOR PROBLEM

BY

THEODOR CARL MÜLLER

TALL buildings offer so many possibilities in the way of arranging mass and in use of materials and the amplification of anything the architect may wish to express, that their habitability, their circulation dependent upon the elevator, may suffer. Through the architect's preoccupation with the building as an expression, the elevator, which appears to be entirely within the province of the engineer, remains with many of its architectural possibilities unsounded. Formerly it was the continual complaint of the elevator engineer that he was called in at some stage of making scale drawings where his success was handicapped beyond a solution by mechanical skill. It is much to the credit of the manufacturers that they have largely overcome this condition through their continued efforts to coöperate with the architect at the outset, and through their maintenance of a staff of experts and specialists in service determinants, whose aid the architect may enlist previously to the contracting for an elevator system. One views with hope a closer coördination of function and expression as a single factor dependent upon human want.

The service aspect of an elevator system finds an immediate index to its success in the popularity of the building and the consequent rentals in relation to competing buildings with superior elevator systems. Unless passengers are to be shot upward in a radically different way, the possible limits of speed have been reached. By increasing the velocity of the car over 600 feet per minute, it was found that the operator could not reduce the round trip time because of the premature slow downs necessary for a safe landing. But with the introduction of automatic operation, a velocity of 900 feet per minute was feasible and time lost in landing was completely eliminated by use of micro-leveling apparatus. Greater velocity would be neither comfortable nor profitable in view of the added installation and operating costs. The further development of speed lay in the perfection of the signal systems, the closer coördination of the work of the starter and the despatcher with the individual operators, and the greater efficiency due to by-pass switching for crowded or delayed cars. Here, too, the development has gone so far that greater speed is dependent upon facilitating, through design, the recognition of the signals by the public.

Of great credit to the service in general has been the avoiding of accidents, nine-tenths of which are now landing and door accidents. Carelessness is the chief cause of these, but to further fool-proof the system, solid doors with hydraulic or air checks and solid gates may be specified, and the sizes of door openings be diminished. Free the operator mechanically from the hand operation of both car and door, so that he may devote himself to guarding against carelessness on his part and on the part of the passengers. The expense of such improvement would be somewhat lessened by a reduction of insurance costs. The possibility of general improvement of the system, therefore, lies chiefly in bringing the designer's skill to deal with the features so well secured by the engineers, in collaborating more fully on future evolution, and in the care taken with car interiors and with exterior doors, which by their very nature as design problems, have been widely abused by thoughtlessness and incompetence.

Determinants. General service determinants limit discussion because of their dependence upon the individual building and also because the hypothetical case, as much as the actual, demands the specialized knowledge of an expert versed in probability theory and load plotting. Coupled with an expert solution, goes the speculation of the building committee as to what may develop over a period of years, the type of occupancy, altering perhaps the amount of rentable area, and giving a different quality of service. Single tenant occupancy may result in a great increase of inter-floor traffic, as well as in unusual peak loads. The impracticability of designing for the abnormal traffic of a rush hour forces a choice between congested and delayed service and the stagger system, a remedy which gains the popularity of the public but slowly. Its desirability is obvious, but experience has found it to be in conflict with the human gregariousness which, for example, makes a person prefer to ride in a packed subway with a friend than to sit alone. The business habits of a tenant may cause tremendous peak loads at nine, at noon and at five. While it would hardly be economical to condition a service by the peak loads in the proximity of a railroad terminal where delays cause the missing of trains, concessions to the evening rush hour may prove profitable. In buildings for professionals, the "in and out" curves will not rise to such abrupt heights at nine and five as in those tenanted by organizations whose staffs are made up chiefly of clerks and stenographers. However, the natures of the professional's clients are a vital determinant. The ailing human being, no matter how desirous of receiving the attention of a doctor or a dentist, should not be whisked upward at a

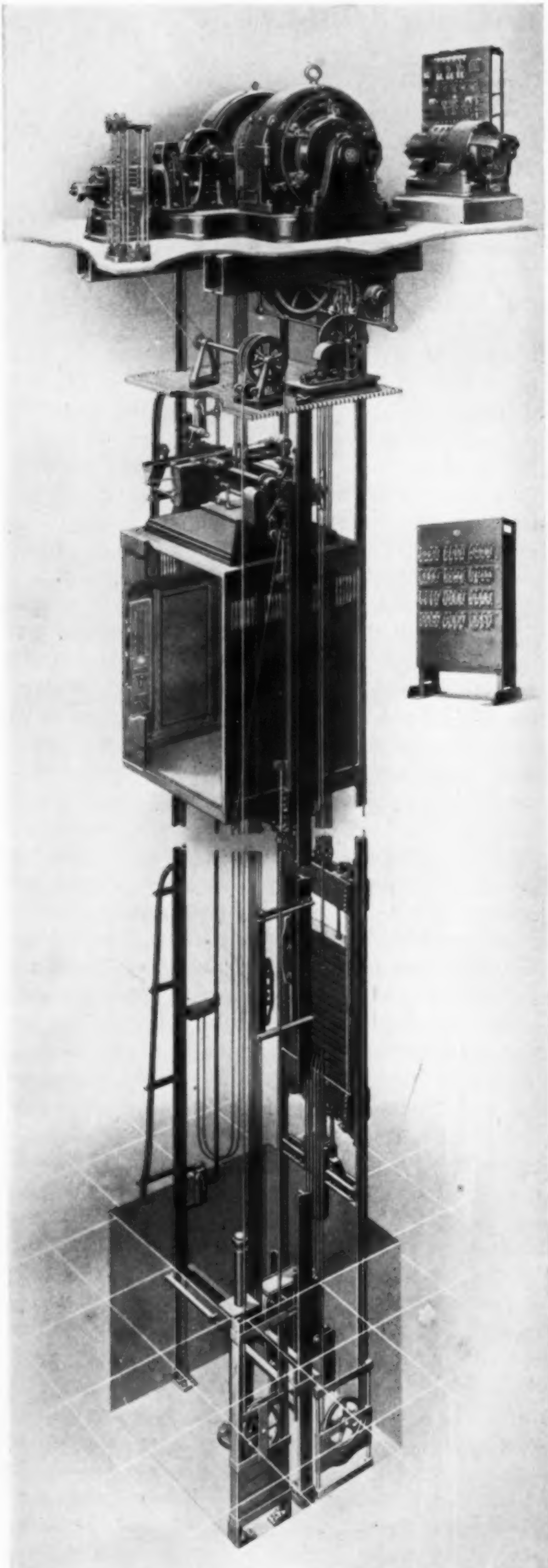


Diagram of Automatically Operated High Velocity Elevator

rate of 900 feet per minute and should be let down with extraordinary care, while the worried man hastening to his lawyer, cannot be judged on the basis of "normal patience."

Just what "normal patience" is, how long the intending passenger will wait for a car, and how long he can be expected to stay in a car without tax on that patience, is debatable. In general, service with a 20-second interval between cars has been found satisfactory, and that with a 30-second interval is considered fair. The passenger entering the building will be more satisfied to find a waiting car at the lobby floor than to find a bank of closed doors, for the seconds waiting *in* a car seem shorter than those waiting *for* it. Without an actually proposed building with all its elements known and the speculation about its future established, even the expert could not be expected to decide what would be successful interval and round trip time, nor could he make "in and out" studies from which the number and speed of elevators could be computed. Likewise, without a known location, no judgment could be passed on the proportion of area cost to service cost.

Square footage rentals may influence the planning of a building to such an extent that no expense need be spared in minimizing the area occupied by elevator shafts. The saving of several square feet on each of 40 floors may appear finally as a matter of astounding importance in the annual rental. But where this is not the case, the balance is a delicate matter. The added convenience of all that modern developments can offer is not as readily evaluated as square footage saving, and the building owner is likely to err on the side of immediate economy, incurring the risk to his building of the strong competition of a neighboring, fully equipped structure.

The greater cost of installing high velocity cars, with micro-leveling devices and automatic doors, carries with it an increased power cost, an appreciable factor in the building's overhead. This balances against a service impaired by inching to the landings and the operator's gradual fatigue in handling doors.

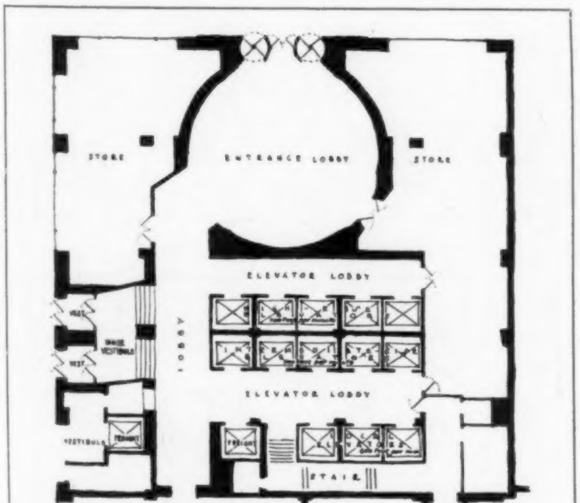
Circulation Area. The ground floor plan controls elevator accessibility and involves the handling of peak traffic. By comparison, planning the upper floors is hardly problematical. The advisability of segregating the intending passengers from the through lobby traffic and general ground floor circulation is obvious and has resulted in use of the highly effective blind wing corridor. Good practice in blind wing planning divides the elevators into groups of six or eight, arranged on both sides of a short corridor, each wing taking a proportionate amount of the traffic by serving but a portion of the building. These corridors open from a general lobby, which facilitates the

directing of passengers and the signal coördination of the starters and despatchers. A starter's indicator panel is indispensable in a large installation and should be centrally located.

When the architect has arrived at successful space distribution of the ground floor circulation, an equally successful time distribution remains to be developed. From the scheduled rate of reception and discharge of passengers, circulation areas are dimensioned with the aid of such empiricisms as the allowance of a 4-foot aisle for every 50 persons passing per minute, adding a 2-foot clearance in front of walls or free-standing columns and a 4-foot standing room space before booths and elevators facing the aisle. Where circulation area is closely computed, crowding may be extremely detrimental, and nothing endangers functioning more than multitudes arriving at one time. The need for time distribution resulted in the use of revolving doors, because of their known capacities. For example, an ideally dimensioned revolving door, 7 feet, 6 inches in diameter, admits a maximum of 50 people per minute. Prejudice against the revolving door, because of its unpopularity with the public, especially where it must admit a large percentage of women and children, and because some building laws forbid its sole use, has led to control by careful adjustment of narrow entries.

The determination of just what elevator equipment will do after installation has developed far beyond its early mystery, and yet it is not subject to any strict formula. By experience and the specialized knowledge of probabilities, there is being rendered service that agrees closely with the lines of theoretical calculations.

Retaining the visibility of doors becomes a



Daily News Building, New York
John Mead Howells and Raymond M. Hood, Architects

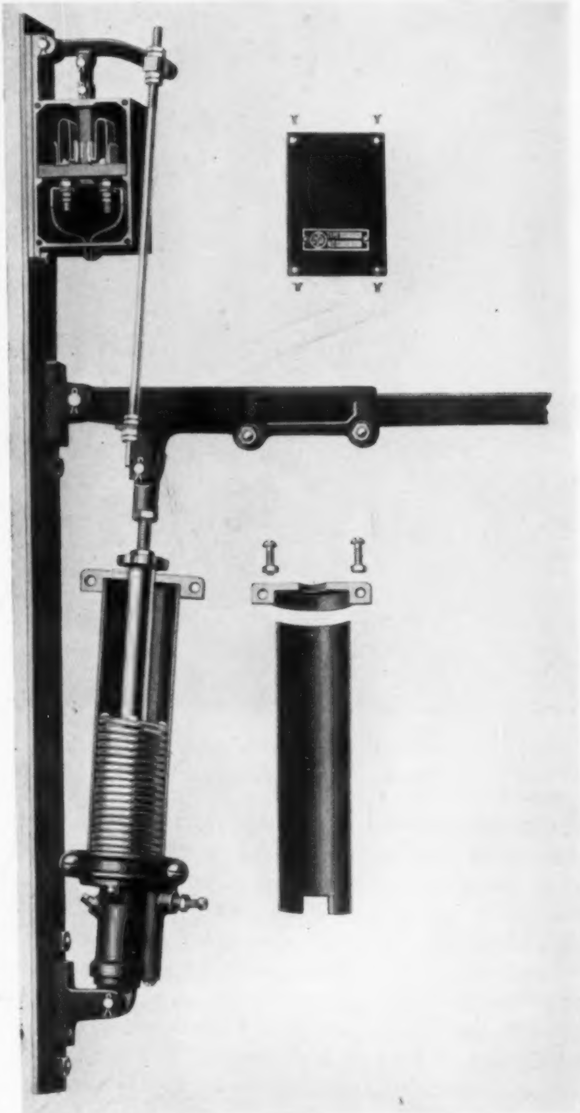
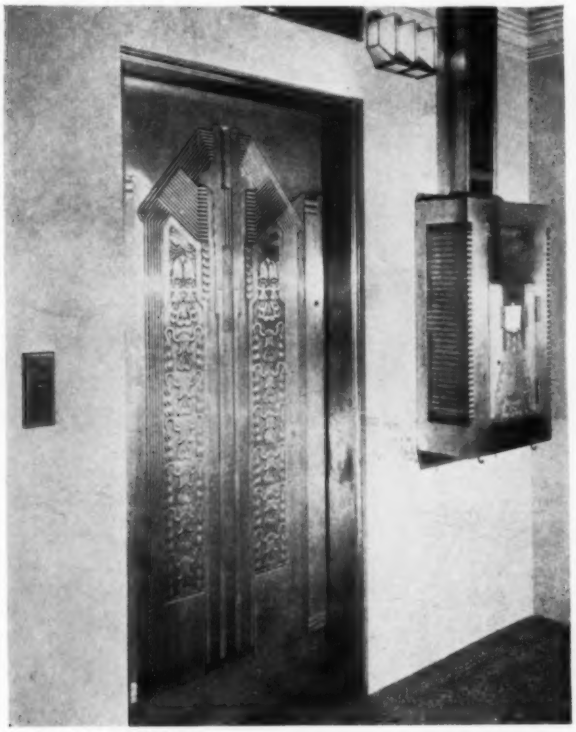


Diagram of Landing Door Check

problem as circulation areas are minimized, corridors narrowed, and sight line angles reduced. Later, under the designing of individual features, an attempt will be made to show how dependent is the service upon the collaboration of the human element, and how much the human being can be influenced by design to collaborate automatically.

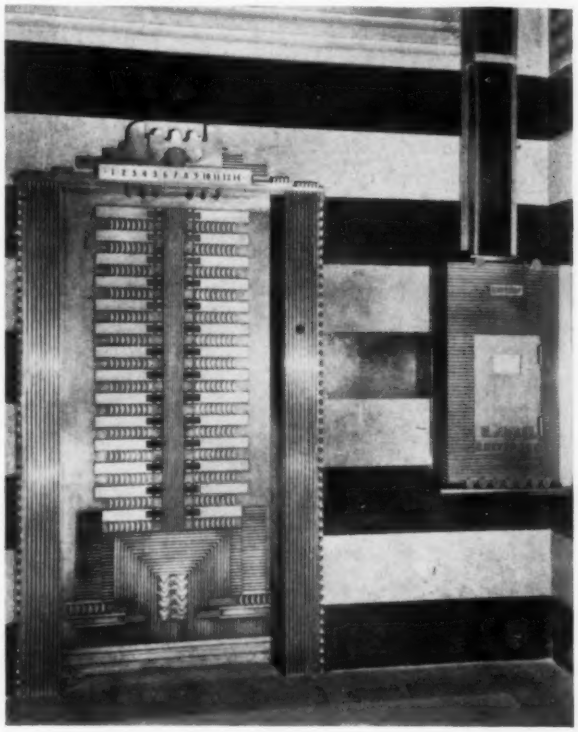
Considering here the factors bearing chiefly on the plans and early scale drawings limits discussion to the actual structure. By far the most practical method of rendering the elevator entrance readily seen and accessible is the use of splayed jambs. Theoretically an arrangement of entrances on the arc of a circle or the use of converging walls in the blind wing plan would obviously accelerate circulation, and it might become general practice were it not for complications in construction and the planning of upper floors. Fortunate-



Photos. Sigurd Fischer

Elevator Doors, Federation Building, New York

Buchman & Kahn, Architects



Elevator Doors, Film Center Building, New York

Buchman & Kahn, Architects

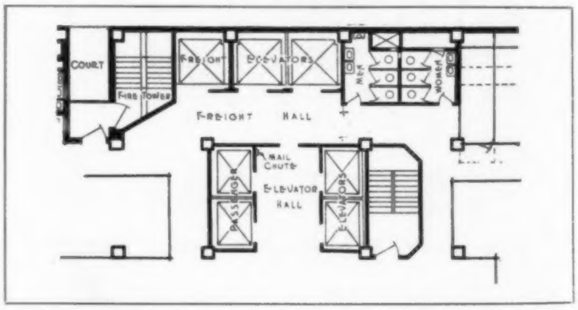
ly, the alignment of six or more elevators in a row has condemned itself, through waste of corridor space and the forced waiting of cars at the other end of the line from the intending passenger.

Shaft Area. To minimize shaft areas in the average tall building contributes more to its success than minimizing circulation area, not only because the shaft saving increases with every story, but also because an excess of corridor space over and above its functional necessity has in the main floor a very real value in contributing dignity and spaciousness. It may afford the only opportunity in the building for architectural treatment.

The elevator corridor of the Film Center has, in the extraordinary motivation of the ceiling, the quality of influencing circulation into the elevators through depression along the axis and, by achieving an acute angle at the intersection with the shaft walls, it emphasizes them with a directional movement upward. As the building increases in height, the percentage of the area devoted to elevator shafts becomes greater, and the profit that might be derived from an appreciable reduction of shaft space becomes considerable. More and more radical reductions will be made, no doubt, to permit an advance in building heights.

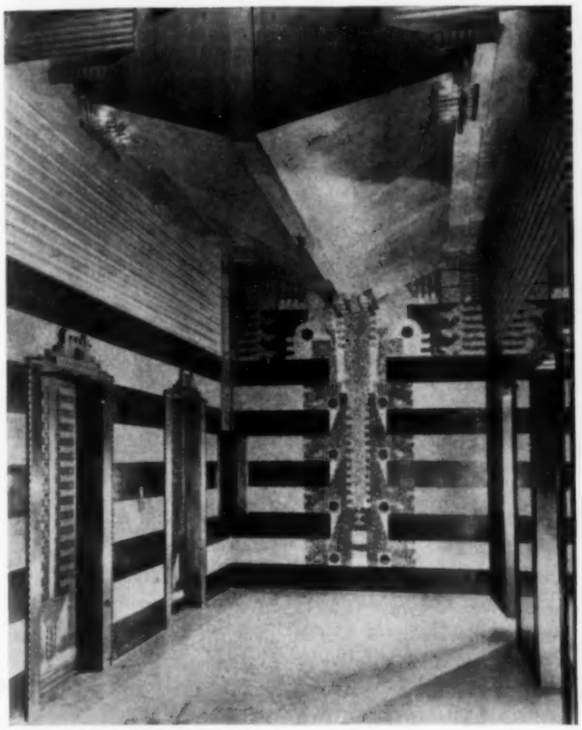
How much the introduction of automatic operation has done is best exemplified in those instances where hand-operated elevators were in use. It is invariably found that fewer automatically-operated cars are an adequate substitute for the hand-operated cars. What future economies will be possible is pure speculation. The healthiest sign, however, is that although manufacturers are loath to prophesy regarding tomorrow's elevator, they are equally reluctant to consider today's elevator as perfected, and they work with its obsolescence continually in mind.

There has been suggested a double-deck car which would serve two consecutive floors at once and terminate in two entrance hall floors, each ramping half its height to the street level. Other proposals involve the idea of there being more than one car per shaft. A local might serve the first 20 floors of a building, following an express serving the upper 20. Safety from collision is insured by the use of electro-mechanical guard and blocking devices, similar to those used on electric railways. Or else three locals might run opposite



Elevator Plan, Film Center Building

Buchman & Kahn, Architects



Photos. Sigurd Fischer

Elevator Lobby, Film Center Building, New York

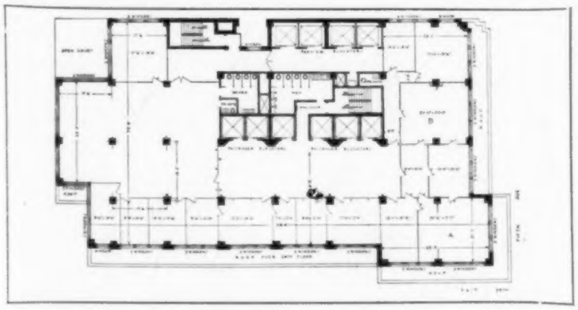
Buchman & Kahn, Architects

Elevator Lobby, 261 Fifth Avenue, New York

Buchman & Kahn, Architects

an express, stopping at terminal floors, blocking devices making it possible for both an upper and a lower car to stop at the same terminal floor without danger. The desirability and simplicity of these proposals come into question when the engineer begins to attack the problem of getting lifting power to the cars. The hydraulic car and the climber were superseded by the counter-weight cable car, where the foot pounds of power have direct relation to the number of passengers and are not wasted on the weight of the apparatus.

Regardless of drastic diminution of shaft requirements, the number of inches involved in the solution of the ideal car size remains significant. The fallacy of using increased depth is indicated in the time lost when a person at the rear of a crowded car attempts to get off. Using an increased width has the same objection if the door



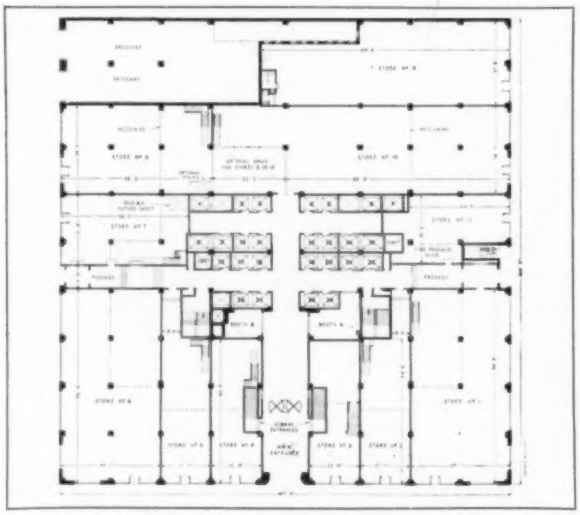
Typical Floor, 261 Fifth Avenue, New York

Buchman & Kahn, Architects

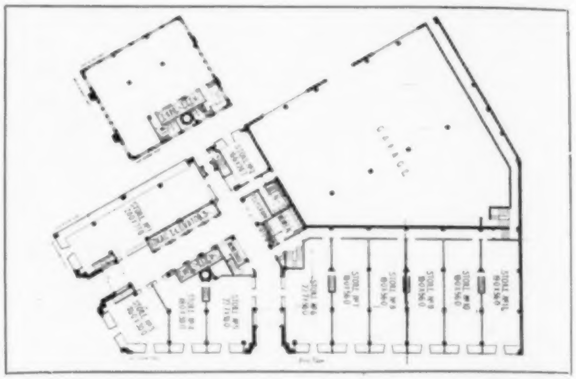
is narrow, but with the wide door, the operator has less control over passengers and encounters forced waits, due to jamming and overloading, especially on the upper floors where there is no starter, and this aside from exposing the system to the danger of the entry accidents already mentioned. Somewhere between these extremes the ideal car size is to be found, and it is influenced by the size of the building and the speed of the scheduling. Ostensibly the small car making rapid trips is better suited to tall, narrow buildings, and the larger car is adapted to a building of less story height, where several passengers are likely to get off at the same floor. The most desirable car sizes range between 7 feet wide and 5½ feet deep, and 7 feet wide and 6½ feet deep. The highly successful installation in the Equitable Building, New York, includes a car 6 feet, 10¼ inches wide by 5 feet, 2½ inches in depth. Often in one building of the set-back type, several differing sizes are used, the high-rise cars smallest, the intermediate-rise cars of medium size, and the locals quite large. In the State Tower Building, Syracuse, the expresses running from the 10th to the 21st floors are smaller than the locals running only to the 10th. In this building one finds an excellent example of the use of the "combination car." Isolated by a separate signal system, this car does the freight work during the day and is most advantageous for the night duty of passengers and

State Tower Building, Syracuse
Thompson & Churchill, Architects

freight. During rush hours it may be switched into the general signal system and aid in coping with the peak loads. It is the one car that serves every floor. The shaft doors serving the "combination car" slide as the others and may swing open to permit entrance to the full breadth of the car. The architects permitted the dimensions of this door to control that of the others, because it made possible uniformity of design and greater domination of the corridors. The shaft is from 8 to 12 inches in excess of the car dimensions on



Park Avenue Building, New York
Buchman & Kahn, Architects



Ground Floor; 18th Floor Plan Above
State Tower Building, Syracuse
Thompson & Churchill, Architects

three sides. The floor entrance doors are generally constructed with jambs that approximate the width of the car, but the actual opening is controlled by the sliding doors which are permitted to open but from 3 to 3½ feet, a dimension which has been found generally satisfactory.

In dealing with a proposed building whose future is made uncertain by a host of probabilities, the architect should take into account the possibility of there being a demand for more elevators, and should show on his plans the location of future shafts that there may be no conflict with the steel or with the general functioning of the plans if additional elevators should be found necessary at a later date. The Park Avenue Building, New York, presents an admirable example of planning where almost any variation of usage can be accommodated. The plan permits of a possible future shaft, and in addition to an installation of 26 elevators, it includes three blank shafts to care for future wants.

Significant to the importance of these elevators is a quotation from the architect, Ely J. Kahn, writing on the "Economics of the Skyscraper": "The height of the building was determined through a table of calculations largely affected by the number of passenger and freight elevators serving the various floors. The set-back conditions, column centers, standpipe regulations, stairways, toilets and the like, fixed the extent of the service portions, and the relations of the usable space to the unproductive area determined reasonably soon at what floor to stop."

The danger of writing of the elevator problem lies in departing from generalities. One corporation found regretfully that the dissemination of data led more to a misconception of the problem than any aid to its solution, and now it devotes all of its energies to working with the architect.

The author wishes to acknowledge the courtesy of the Otis Elevator Company in providing the diagrams on pages 760 and 761.

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SOUNDPROOFING APARTMENT HOUSES

PART II

BY

V. L. CHRISLER

ASSOCIATE PHYSICIST, U. S. BUREAU OF STANDARDS

A PREVIOUS paper upon this subject, published in THE ARCHITECTURAL FORUM for January, dealt with the methods by which sound is transmitted through partitions of apartment houses and discussed some of the changes in construction that were desirable to obtain better sound insulation. It is the intention in the present paper to give numerical data on some of the more common types of construction and to explain what is meant by the results.

Methods of Expressing Results. All of the results referred to in this paper have been obtained by the use of the telephone as a detector and measurer of sound energy. The indications of this instrument are given on what is called the "physical scale," which measures the energy of the sound wave. But the instrument most universally used for detecting sound and estimating its intensity is the human ear, and unfortunately the ear does not respond according to the physical scale. As the intensity of a sound increases steadily on the physical scale, the response of the ear fails to keep pace with it. There appears to be in the ear a regulating or protective mechanism whose nature is not understood, which, like the well known mechanism of the eye, protects the organ against excessive stimulation. Experiment shows that the response of the ear is proportional to the logarithm of the physical intensity, that is, energies proportional to 10, 100 and 1,000 would produce in the ear effects proportional to 1, 2 and 3 respectively. This logarithmic scale has sometimes been termed the "ear scale." The telephone engineers[1] for some time have been using a scale expressed in sensation units. This scale merely multiplies the numbers on the ear scale by 10, the unit of this new scale being that fractional change in intensity which is approximately the smallest that the average ear can detect. For this reason this unit is called a "sensation" unit. In the example given, the intensities corresponding to 1, 2 and 3 on the ear scale would be represented by 10, 20 and 30 sensation units. Wallace Waterfall, in a private communication, has suggested the illustration of the values of the sensation units in familiar terms. We may call it an "ear sensation scale" (Fig. 1).

Ear Sensation Scale. When considering a partition as a sound insulator, one wishes to know by how many sensation units a sound will be reduced when listened to through the partition. To illustrate this, suppose we refer to the ear sensation scale. Assume the intensity of a sound to be 80 sensation units, but when listened to through the partition it is 30. The reduction factor in sensation units of the panel would be the difference between 80 and 30, or 50.

Discussion of Results. The present paper gives the results of sound transmission measurements on a number of panels representing the usual types of construction. Table 1 gives the results of sound transmission at four different frequency bands, and also the average. Panel 30c gives an example of a double wall. The sound insulation is considerably more than it would have been if a single panel of the same weight had been used. Panel 59a is another illustration. In this case the panels were tested in a horizontal position, the upper panel being supported at the four corners by wooden blocks. Panel 59b was the same as 59a, except that hair felt pads were placed above and below the wooden blocks supporting the corners of the second panel. The air space was the same as for 59a. The pads improved the sound insulation by approximately seven sensation units. An improvement of about this much can generally be expected by the use of pads, providing no nails are driven through so as to spoil the effect of the pad as a sound insulator.

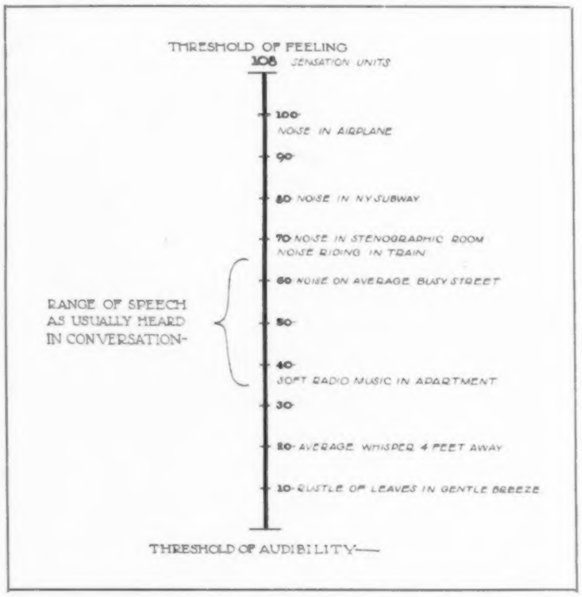


Fig. 1. Diagram Illustrating the Values of Sensation Units

[1] Fletcher: Bell Telephone Laboratories, Reprint B-152-1, *Journal Franklin Institute*, September, 1923.

DESCRIPTION OF PANELS					REDUCTION FACTOR IN SENSATION UNITS FOR FREQUENCY BANDS INDICATED					
Panel Number	Kind of Studding	Kind of Lath	Kind of Plaster	Plaster Coats	Panel No.	250–257	1000–1087	2000–2570	3000–3470	Average
3	Wood	Wood	Lime	Scratch and brown coats only	3	58.9	64.2	76.6	76.6	69.1
4	Wood	Wood	Gypsum	Scratch and brown coats only	4	43.7	39.3	50.7	53.9	46.9
5	Wood	Wood	Lime	3 coat smooth finish	5	53.8	50.6	67.0	72.0	60.9
6	Wood	Wood	Gypsum	3 coat smooth finish	6	31.4	42.9	42.1	54.5	42.7
9	Wood	Metal	Lime	Scratch and brown coats only	9	62.9	63.2	74.7	73.3	68.5
10	Wood	Metal	Gypsum	Scratch and brown coats only	10	51.7	51.7	53.9	57.5	53.7
11	Wood	Metal	Lime	3 coat smooth finish	11	55.3	61.0	63.9	67.5	61.9
12	Wood	Metal	Gypsum	3 coat smooth finish	12	53.1	53.1	55.0	58.9	55.0
13	Wood	Wood	Lime	3 coat sand finish	13	50.5	54.6	61.4	61.7	57.1
14	Wood	Wood	Gypsum	3 coat sand finish	14	51.0	43.9	57.5	60.0	53.1
15	Wood	Wire	Lime	3 coat smooth finish	15	58.7	61.3	61.6	59.7	60.3
16	Wood	Wire	Gypsum	3 coat smooth finish	16	49.0	47.5	58.3	59.6	53.6
18	Wood	Plaster board	Gypsum	3 coat smooth finish	18	52.6	50.5	55.2	57.5	53.9
22	Metal	Metal	Gypsum	Solid partition	22	42.1	44.5	49.1	49.0	46.2
26	Brick 4″	None	Gypsum	Brown coat smooth finish	26	46.4	48.8	58.4	61.3	53.7
28	4″ Clay tile	None	Gypsum	Brown coat smooth finish	28	39.1	35.7	59.3	57.0	47.8
30b	3″ Gypsum tile	None	Gypsum	Brown coat smooth finish	30b	43.1	39.3	42.1	43.5	42.0
30c	Double wall gypsum tile	None	Gypsum	Brown coat smooth finish	30c	52.6	56.1	65.3	73.5	61.9
39	Wood	Wood	Lime	3 coat lime and Keene's cement, smooth finish	39	53.5	60.7	71.6	57.1	60.7
50	Wood	Gypsum wall board	None		50	43.5	46.4	48.7	39.7	44.6
55	Wood	½″ Fiber board, one side	None		55	23.1	24.9	29.6	29.3	26.7
57	Wood	Gypsum wall board, one side	None		57	34.8	33.4	35.1	30.7	33.5
59	Metal	Metal	Gypsum	Solid partition						
59a	Metal	Metal	Gypsum	Two solid partitions air space between	59a	35.7	50.0	62.4	68.2	54.1
59b	Metal	Metal	Gypsum		59b	48.5	50.9	72.4	72.0	61.0
59c	Metal	Metal	Gypsum	Two solid partitions hair felt between	59c	49.0	51.3	71.5	69.0	60.2
59d	Metal	Metal	Gypsum	Two solid partitions seaweed between	59d	49.4	49.4	74.7	70.1	60.9
59e	Metal	Metal	Gypsum	Two solid partitions fiber board between	59e	54.1	54.6	75.6	71.9	64.1
60	12″ Clay tile (2 unit)	None	Gypsum	Brown coat smooth finish	60	49.4	37.0	55.2	53.6	48.8
62	8″ Clay tile	None	Gypsum	Brown coat smooth finish	62	44.3	48.9	58.0	53.2	51.1
63	6″ Load bearing, clay tile	None	Gypsum	Brown coat smooth finish	63	38.8	46.6	53.5	54.7	48.4
64	6″ Partition clay tile	None	Gypsum	Brown coat smooth finish	64	41.2	45.1	52.1	52.7	47.8

Table I. Results of Sound Transmission Tests

Panels 59c, 59d and 59e show the effect of introducing material into the air space. Panels 59c and 59d give the same sound transmission within experimental error as 59b. Panel 59e shows some improvement,—approximately three sensation units. This improvement would hardly appear sufficient to justify the additional cost. The results from this group of panels indicate that practically all of the sound energy was transferred from the first surface to the second through the corner supports, and that if filling material is introduced loosely into the air space in such a wall, it has little if any value in improving the sound-insulating qualities of the wall. This agrees with the results found by Paul Sabine[2] for hair felt. It has been a common assumption with builders that good (felt) heat-insulating materials are likewise good sound insulators. Experiments do not bear this out. In some cases there is a slight improvement in sound insulation. In many cases there is no improvement, and in a few cases a filling material which is a good heat insulator may actually decrease the sound insulation. Various attempts have been made to improve wood stud construction so as to obtain better sound insulation, but none of the structures tested have proved to be better than some of those given in Table 1. For masonry construction there are apparently three methods for improving the sound insulation: (1) The wall can be made very heavy, but in many cases this is not practicable. (2) A double wall can be built as illustrated by 30c. This wall gives very good sound insulation; it is not excessively heavy, but is rather difficult to build, as it is essential that mortar should not be dropped into the air space and thus form a tie between the two walls. (3) The wall can be built in layers as described in the first paper (January, 1929). The numerical results for this work are not available at the present time, but the indications are that they will be about the same as for a double wall.

In addition to transmission measurements made with the telephone as a sound detector, a good many audibility tests have been made by different observers of the Bureau of Standards with different panels under test. From these observations some general statements as to the meaning of the reduction factor might be made by classifying the panels in four groups:

1. Panels whose reduction factors are *over 60 sensation units.* Conversation carried on in an ordinary tone of voice is reduced to inaudibility in passing through the panel. If there is an external noise in the listening room, a shout on the other side of the panel would be practically unnoticeable.

2. Panels whose reduction factors lie *between 50 and 60 sensation units.* Conversation in ordinary tones heard through the panel is barely audible but unintelligible. If the voice is raised, it may become intelligible.

3. Panels whose reduction factors lie *between 40 and 50.* Conversation in ordinary tones heard through the panel is quite audible, but difficult to understand. If the voice is raised, it becomes easily intelligible.

4. Panels whose reduction factors are *less than 40.* Conversation in ordinary tones is distinctly audible and intelligible through the panel.

These comparisons are based on tests in a listening room in which there was no noise, and which was quite reverberant. In a room furnished with rugs, draperies or other sound-absorbing objects, the result would be apparently more effective than when tested in bare rooms. Attention must also be called to the effect of external noises. If a panel having a reduction factor of between 30 and 40 sensation units is taken as an example, these facts may be noticed. If there is no external noise, and if the panel acts as the wall between two rooms which are fairly reverberant, it is quite easy for two people who are on opposite sides of the panel to carry on a conversation; but if there is the slightest noise in the room where the person is listening, the conversation becomes a mumble, and the chances are that not a single word will be understood. The louder the noise in the room, the greater the masking effect.

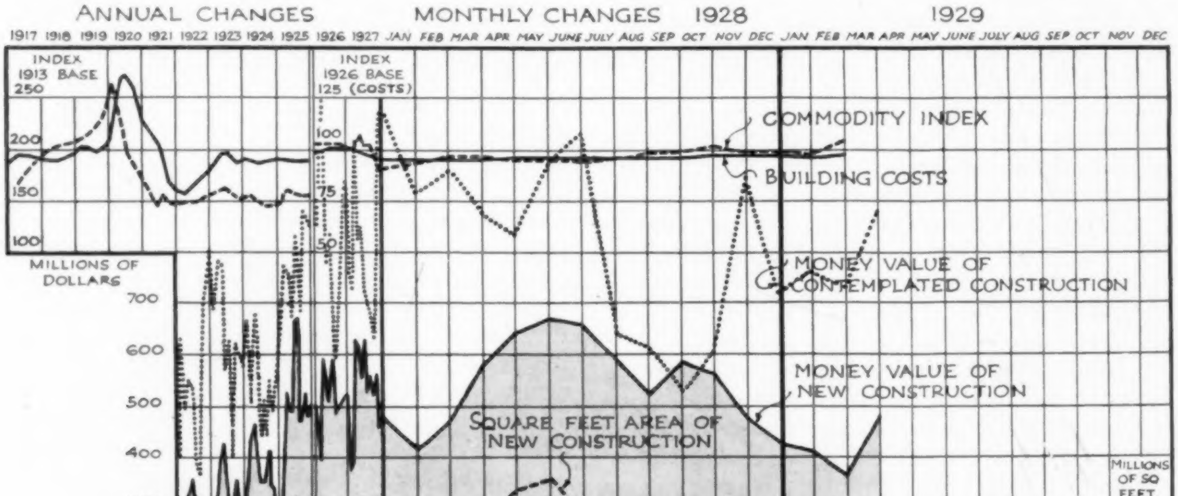
From this it is readily seen that a partition might give entirely satisfactory results under some conditions while under other conditions it would be unsatisfactory. In other words, when choosing the type of partition to give proper sound insulation, two things should be known,—the intensity of the sound which it is desired to reduce to inaudibility, and the minimum intensity of the sounds present in the room where the listener is located. For instance, very slight noises in this room might mask any sound having an intensity of 20 or less sensation units. If the noise which we wish to reduce to inaudibility has an intensity of 70, the wall or partition should have a reduction factor of 50. This will reduce the sound to an intensity of 20 units, and this would be masked by the other noises present so as to be inaudible. If the room is absolutely quiet, it will be necessary to have a partition with a reduction factor of 70 to reduce the sound to inaudibility. Whether a partition is satisfactory or not, therefore, depends upon the intensities of other noises present as well as upon the sound-insulating qualities of the partition which is built.

[2] Paul Sabine "Architectural Acoustics," *The Armour Engineer*, May, 1926. He also found that heavier materials, such as sawdust and slag, increased the sound transmission.

THE BUILDING SITUATION

A MONTHLY REVIEW OF COSTS AND CONDITIONS

THE money value of construction contracts awarded in the 37 eastern states during the month of March is given by the F. W. Dodge Corporation as $484,847,500. This represents an increase of 34 per cent over the value of contracts awarded during the previous month, but a decrease of 18 per cent from that of March of last year. For the first quarter of 1929 the total given is $1,256,089,300 which is 15 per cent below the figures for the first quarter of 1928. In the section which includes New York and northern New Jersey, the March contract total of $111,539,200 exceeds that of February by 49 per cent, but it was 27 per cent below the total for March of 1928. For the quarter the 1929 total showed a decrease of 32 per cent from that for the corresponding period of 1928. The New England March construction total was $31,970,300, an increase of 21 per cent over February and a decrease of 24 per cent from that of March of last year. The contracts for the first quarter amounted to $87,719,400, which was 13 per cent below the total for the corresponding quarter a year ago. The Pittsburgh district showed improvement of 10 per cent for the first quarter of 1929, with a total of $160,372,700, as compared with the first quarter of 1928. The March figures of $52,965,900 were 6 per cent above those for February, but 31 per cent below March, 1928. An even stronger upward trend is shown for the northwest, where the March total of $5,494,300 exceeded that of February by 47 per cent and equaled the total for March, 1928. For the first quarter in this district an improvement of 43 per cent over the first quarter of 1928 is noted, with a total contract valuation of $12,750,200. In the middle Atlantic states, the central west, and the southeastern states, similar trends were in evidence. The middle Atlantic states, with March contracts valued at $59,069,200, showed an improvement of 17 per cent over February, but a decline of 16 per cent from March of 1928. The total for the first quarter, $119,517,700 was 5 per cent below that of the first quarter of 1928. In the central west the March total of $159,609,300 was 61 per cent above February, but 9 per cent below that of the previous March. For the first quarter of 1929 this district lagged 16 per cent behind the figures for the corresponding period of 1928. The southeastern states, with a total of $115,011,400 for the first quarter of 1929, were also 16 per cent behind their 1928 figures for a similar period.



THESE various important factors of change in the building situation are recorded in the chart given here: (1) *Building Costs.* This includes the cost of labor and materials; the index point is a composite of all available reports in basic materials and labor costs under national averages. (2) *Commodity Index.* Index figure determined by the United States Department of Labor. (3) *Money Value of Contemplated Construction.* Values of building for which plans have been filed based on reports of the United States Chamber of Commerce, F. W. Dodge Corp. and *Engineering News-Record.* (4) *Money Value of New Construction.* Total valuation of all contracts actually let. The dollar scale is at the left of the chart in millions. (5) *Square Foot Area of New Construction.* The measured volume of new buildings. The square foot measure is at the right of the chart. The variation of distances between the value and volume lines represents a square foot cost which is determined, first by the trend of building costs, and second, by the quality of construction.

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WALL STREET ENTERS THE BUILDING FIELD

BY

JOHN TAYLOR BOYD, JR.

WHAT part will the architect play in the profound changes which may be impending in construction and real estate, if the movement toward huge scale operation, starting in New York, continues to develop? Recent months have witnessed a startling series of immense mergers, combinations and financial alliances of construction and real estate interests,—including in one case, a group of well known architects. Two of these combinations have provided themselves with the sinews of war in the shape of strong Wall Street backing, and all for the purpose of issuing securities for real estate and construction developments. The successive announcements of these programs were enough to surprise even New York, accustomed as it is to vast enterprises. In the present era, economic changes arrive in an industry with devastating swiftness,—often, alas, catching individuals unprepared. If such is to be the case in the construction field, architects might find it to their advantage to note these recent happenings and to mark whatever future progress they may make. For it is not impossible that the building industry and its allied activity, real estate development, may at last be affected by that trend toward large financial combinations which has become characteristic of American industry.

Chiefly the matters here under consideration are of these three kinds:

1. The launching of the huge real estate-construction-financing organizations and combinations just referred to,—in particular the Beaux-Arts Development Corporation, a syndicate composed chiefly of architects under the presidency of Kenneth M. Murchison, in combination with the U. S. Realty & Improvement Company and its construction subsidiary, the George A. Fuller Company, and with the backing of the National City Bank in a program that is announced in the New York press as contemplating expenditure of $100,000,000.

2. New methods of financing contemplated by these huge organizations, involving issuing securities to the public for both a part of the equity and for the mortgage portions of cost of a building operation, the effect of these financial plans, however they vary in details, being to supply almost unlimited funds at a much lower cost than could be done by conventional real estate methods.

3. The organization of the Real Estate Board of New York Exchange intended to develop a public market for real estate securities of all classes.

Naturally, such a far-reaching development is causing no little discussion,—not to say anxiety,—as to what may be its effects on the building industry and the various interests within it. So far, the new movement does not seem dangerous to the architect, but quite the contrary. In contrast with similar attempts in the past to establish huge construction-financing concerns, in which the architect was eliminated except as an employe, these companies generally retain independent architects for their buildings on a professional basis. Furthermore, since they issue long-term securities against their properties, they have a strong motive for having these properties hold their value during the lives of the issues. On this account they recognize that sound architecture is a factor in giving *investment values* to buildings, as distinguished from a *speculative status*.

But if there is no threat to architecture involved, this cannot be said of some of the other interests in the construction industry,—namely, contractors, promoters, "operators," material manufacturers, and real estate financing organizations. Others among these interests, on the other hand, should profit by a trend toward large scale building. The material manufacturer, for example, will approve of the large transaction, carrying with it large single orders, excellent credit risk and a demand for durability of construction. If the lightning strikes in his direction, it may be in the form of mergers or combines among the 10,000 or more manufacturers of building materials and equipment, if the example of the American Radiator Company-Standard Sanitary Manufacturing Company merger finds imitators. The fact that the stock of these two companies was listed on the New York Stock Exchange is significant in two ways,—first, it invited the merger, and second, it allows the companies concerned to obtain their supplies of capital on the favorable terms which that securities market affords.

One interest, however, may find the competition of these combinations formidable. That is the "old line" mortgage-bond companies and the junior mortgage finance companies, whose charges for discounts may require drastic revision in order to bring the costs of their financing down to the level of that of the newcomers, as will be explained later on in this article. Of course, any such reduction should vastly benefit the building industry. Financing charges in many building operations comprise almost as large an item as do either labor or materials of construction. Fi-

An Example of a Large-scale Project to Cost Approximately $25,000,000

nancing is the one department which offers the greatest opportunity of cutting building costs and thus expanding the market for new buildings. Some of the vast possibilities in this direction I outlined in THE ARCHITECTURAL FORUM for January, 1928,—"Housing, the Responsibility of the Building Industry."

Further possible effects on the various interests in the building world must be left to conjecture as, and if, the movement develops. Obviously, the economic ramifications are too great, and the movement itself is too new, to allow one to make very definite statements as to its ultimate effects. Nevertheless, as a general result, there is likely to occur throughout the industry a drastic scaling down of overhead. The architect also may not escape this turn of fortune's wheel. He might find interesting Mr. Murchison's reply to my question as to how the architect in the smaller towns and cities might fare: "Why not let him put our plan into effect, in combination with the local bank?"

Possibly the new plan will be unfavorable to some real estate promoter or "operator." Today commercial building promotion is generally in the hands of wealthy individuals and their financial following, acting in groups or syndicates, and organized as "private" or "closed" companies, in the language of Wall Street. By contrast, the new method largely,—though not entirely,—transfers the initiative to large "public" corporations which obtain the principal of the cost of a building operation, including a portion of the equity, directly from the public by means of security issues of stock. To anyone familiar with the building industry, this is a significant change.

Another result of these financial plans is to introduce the "chain" principle into real estate, as distinct from the principle of the isolated operation and the "revolving fund" idea. Chains of properties are developed, spreading the financial risk. The chain forms a nucleus for expansion along the lines now familiar in other industries, such as the retail merchandising field. The strength and prestige of the chain allows rapid expansion by making easy the raising of additional capital for each new unit.

This general summary of the new movement becomes clearer in a more specific description of a new organization. The most interesting of the new "mergers" is the combination mentioned of the syndicate of architects, called the Beaux-Arts Development Corporation with the U. S. Realty & Improvement Company and the National City Company. The list of architects who are stockholders in the Beaux-Arts Development Corporation contains familiar names: Benjamin Wistar Morris; Delano & Aldrich; Voorhees, Gmelin & Walker; Charles Z. Klauder; Raymond Hood, Godley and Fouilhoux; John W. Cross; William H. Gompert; James W. O'Connor; and Whitney Warren. There are also four artists and decorators. The construction interest is represented by the George A. Fuller Company, and that of real

View of the Tudor City Group of the Fred F. French Company

estate by Douglas and Roland Elliman and by the U. S. Realty & Improvement Company. The enterprise is backed by the National City Company, which is the securities company of the National City Bank. Obviously, this is a combination strong in every sense.

The first operation of this organization is the Beaux-Arts Apartments, a $5,250,000 project on East 44th Street, Manhattan, near the Beaux-Arts Institute of Design. The architects are the firm of Kenneth M. Murchison and Raymond Hood, Godley & Fouilhoux in association. The Beaux-Arts Development Corporation, the "parent" company, owned the site and contributed it as its part of the project, receiving in exchange second preferred stock in the Beaux-Arts Apartments, Inc., as well as a portion of the common stock, under the novel plan of financing which attracted so much attention in New York when it was announced. The Beaux-Arts Apartment Company is the company formed to put through this single apartment building project. This plan will be described in detail in a later article, along with several others of the sort. At this point it should be noted that the plan involved two major differences from the conventional real estate financing: (a) the mortgages were eliminated entirely, being replaced by an issue of 6 per cent first preferred stock to the amount of 75 per cent of total cost, carrying with it a bonus of the common stock; and (b) the issues were sold by the National City Company and its vast chain of branches and associated investment houses extending all over the country, even to other nations, at an underwriting cost of 5 per cent plus a profit in the form of a bonus of common. This common stock is expected to begin to earn dividends in about 11 years, after a large portion of the preferred stocks is retired. Thus, by using the Wall Street machinery of securities distribution, in this case, the building enterprise obtained the advantages of (1) 75 per cent of the cost at a rate of about 6 1/3 per cent, as compared with a much higher rate charged for a first and second mortgage totaling the same amount, or their equivalent in the conventional mortgage bond issue, in which discounts of from 11 to 18 per cent,—or even more, according to circumstances,—are not unknown, and (3) immediate sale of stock, this particular issue, it is understood, having been sold in *one day*.

But there are two other sides to this triple combination,—that of the U. S. Realty and the National City Bank. The U. S. Realty & Improvement Company was incorporated in 1904, to replace an older concern. Stated in ordinary terms, its field of operation appears to cover nearly all the possibilities of profit in real estate and construction operations. It has various subsidiary companies, including the George A. Fuller Construction Company. The balance sheet of U. S. Realty and its numerous progeny shows total assets of nearly $73,000,000 as of April 30, 1928. Earnings for the year previous were $5,516,302.-

60, equal to $7.52 per share on the common stock then outstanding. U. S. Realty owns several large buildings, including the Plaza Hotel and the Trinity (office) Building, New York. The George A. Fuller Company did a huge construction business last year on the cost-plus fee basis.

Now, in its size and scope of operations, the U. S. Realty & Improvement Company is not, of course, unique. The idea of the large development-financing-contracting company is not new, and examples of it have long been known in various sections of the United States. Familiar instances are the group of engineering-construction concerns, such as the Turner Construction Company, the J. G. White Engineering Company, and Stone & Webster. In the more strictly real estate field, the rise of the Fred F. French organization since the war is familiar. The French Company, in fact, goes even further, in maintaining its own architectural and stock selling departments.

What then is the significance of the U. S. Realty to the building world as an instance of new economic development? The answer is chiefly in its new financial methods. The significance of the U. S. Realty's methods of financing, centering about its alliance with the National City group, is two-fold: (1) possibilities of obtaining capital at low cost for each specific building project, and (2) alternative means of obtaining cheap funds through its listing of its stock on the New York Stock Exchange. The first advantage has been briefly mentioned and will be illustrated more specifically, as noted, in a later article. The second advantage, namely that derived from the "Big Board" listing, appears perhaps most novel to those familiar with conventional building finance. It deserves a brief explanation. On January 1, 1929, U. S. Realty capital consisted of approximately 733,000 shares, no par common, with no senior obligations ahead of this issue of the parent company in the form of bonds or preferred stocks, although there were such obligations and some mortgages outstanding against some of its subsidiary organizations. As noted, this stock earned $7.52 a share for the year ended April 1, 1928, and paid $4 dividends. Stock dividends of 10 per cent each were paid to stockholders in 1925 and 1927. December 31, 1928, the closing price of the stock was 84⅛, the lowest price of the year having been 64¼, on February 4. Its highest price for the year was 93⅝, on May 7.

In these bare, apparently irrelevant, figures there lies a deep meaning. The meaning is, in brief, that shareholders were willing to pay a high price for U. S. Realty, in the hope of reward, not so much in interest return, but in the shape of stock dividends, in rights on new issues, and in the expectation of appreciation of price of the stock itself as the company made money on an increasing scale; also as a result of the favor of its stock among the public, U. S. Realty was able this year (1929) to raise new capital for its various purposes, to the extent of 244,367 additional shares of common stock, which were offered to the stockholders at $80 per share. The point here to be made is the remarkable advantage to U. S. Realty of having its stock listed on the New York Stock Exchange, enabling the company to raise some $19,000,000 new capital on a basis of 5 per cent or possibly a slightly higher rate.

One should not suppose that this apparent drawing of rabbits out of the Wall Street hat is pure financial magic. Notwithstanding the controversy over the gigantic speculation in the security markets, U. S. Realty did supposedly offer something tangible in return for these liquid assets of new capital,—something more than the prospect of speculative appreciation in the price of its stock. These considerations are generally:

1. Liquidity of a ready market.
2. A history of several years' steady expansion in size and earnings, an indication of sound, capable management.
3. Diversification of risk in its operations, conservatively undertaken, in providing a basic necessity of life.
4. Ability to meet competitors on account of the economy of large-scale methods and economical financing.
5. Financial responsibility of the company.
6. Responsible financial statements made public and at stated intervals, as required by the rules of the New York Stock Exchange as a qualification for listing. This is only a part of the spotlight of publicity which beats upon a company whose securities are listed on the "Big Board" where they must compete for the favor of the investing public, advised as it is by an army of investment brokers' experts, against the stock of others of the most powerful industrial and public utility corporations and railroads.
7. Value of stock to investors as collateral, due to its Stock Exchange listing.
8. Partnership in a large, successful company.

Clearly, a huge "public" corporation, seeking the favor of the investment public in a worldwide public market, has its heavy responsibilities, and its own stiff competition to meet, although these may be different from those of the conventional "closed" real estate company. All this responsibility is summed up in the question which the investor asks an investment expert—or his banker: "Which do you think is the best buy at present prices, General Motors or U. S. Realty?"

So U. S. Realty appears to have two strings to its financial bow. Whichever one it chooses to use, the public offers its savings for a low re-

turn. How different this is from the characteristic real estate operation! In the usual operation, only the first mortgage proportion of the project's total cost resembles this favorable situation. But, as everyone knows, terrific charges are demanded for junior mortgage discounts, and the junior mortgages must usually be paid off in a very few years. Worse yet, almost anything must be promised to the wealthy "operators" who are solicited for stock participation, or to the go-between who can influence them to join in the venture. In New York a "proposition" must "show a paper profit" of 15 per cent or more, depending on circumstances, to attract capital for the equity. Another defect of the conventional method is that this crushing burden of finance costs comes heaviest in the first few years of the project's history, at precisely the time when it is being established as a going business. Sometimes the load brings foreclosure to a worthy project.

The other familiar effects of this conventional real estate method of financing naturally follow, —namely, the high speculative risk, the pressure to build for quick re-sale, "shoestring" financing, uncertain credit, and minimum financial responsibility of the promoters through the practice of incorporating each building operation as a separate company. Still other evils follow, each aggravating the others and creating a chain of doubtful links. These are low standards of design, of construction, and of building management; high costs of small-scale production; excessive overhead; and, finally, lack of coördination of the various elements in the building industry which coöperate to produce a building, and the splitting up of real estate into a number of small units and holdings. In contrast, the Beaux-Arts Development Corporation and the U. S. Realty & Improvement Company-National City Company combination follows an almost contrary set of principles. Allowing for the difference of conditions in specific cases, which of the two methods is the better? Which, in the long run, will be the more beneficial to the building industry and to the architect? In any case, the new method, which is simply that which is extensively practiced throughout American business and industry, has certain definite advantages in competition. I believe that we are likely to witness a new development on these novel principles, which are those of large-scale operation. They seem to me to be sound and logical, notwithstanding the fact that there are some dangers.

Three years ago, when our organization, as consulting architects, assisted the New York State Housing Board to prepare its practical program, I had an opportunity to study the matter. This plan is set forth in the article "Housing,—the Responsibility of the Building Industry," published in The Forum for January, 1928, already mentioned. Briefly, it was set forth there that the building industry enjoyed an opportunity for unparalleled activity,—on a greater scale, in fact, than anything which the post-war building boom has yet seen,—in developing a large-scale construction program based on low-cost financing through use of the Wall Street machinery, by this means supplying housing to the middle economic third of the population. Now, evidently, these principles of building organization that were first formulated chiefly by architects are coming into actual operation.

Returning to a specific consideration of these new organizations, a brief mention of the other large concerns may be of interest. The Beaux-Arts-U. S. Realty-National City combination has been chosen as the most typical, and in some ways, most interesting. But it is not the only one of its type. A second great combination of somewhat similar character, though possibly more conventional, is the $42,000,000 General Realty & Utilities Corporation. This concern is affiliated on the construction side with the Thompson-Starrett Company, and on the real estate development side with the Tishman Realty & Improvement Company, the stock of both being listed on the New York Curb. General Realty & Utilities, too, has its Wall Street connection. It is backed by a group of investment houses and other public utility interests, particularly Stone & Webster. On its directorate are representatives of six Wall Street investment houses. Organized this winter, this company, pending development of its program, placed $10,000,000 in construction loans advanced to other builders, and lately it has announced a huge new building project on the East River front of Manhattan.

A third large and expanding organization is that of the Henry Mandel Associates. It resembles the Fred F. French Company in its comprehensive activity in all phases of real estate and building, including the sale of its securities by a department of its own organization. However, it is not "its own architect." Its latest announcement is a $25,000,000 block of 16-story apartment houses on West 23rd Street, of which Farrar & Watmough are the architects. This group, planned two rooms deep, covering as it does 49 1/3 per cent of the site area, and containing a great block garden in the center of the plot, 71 feet at its narrowest, is an example of the enlightened policy of this company toward sound architecture. Its financial plan, which involves the principle of selling securities to the public, based on individual building projects and carrying, in addition, a share in the chain of properties contemplated by the Mandel plan, will be explained in a later article.

The Fred F. French Company is more widely

known, having been established some time, and also being known through its extensive stock selling publicity. Its "Tudor City" development in the Grand Central district of Manhattan covers approximately six acres, extending from 40th to 44th streets and situated between First and Second Avenues. Nine buildings of the apartment or apartment-hotel type are either built or under construction, and a little more than half the site remains undeveloped. There is a huge interior garden equal to two city blocks in the center of Tudor City. The total expenditure in land and in buildings built and now under construction has been about $30,000,000.

It will be noted that both the French and the Mandel organizations do not use Wall Street investment houses to market their securities. Presumably, for their own purposes at least, they market their own stock themselves directly to the public because it is cheaper. Of course, they are thus performing a great task, one that is doubtless possible only because these two concerns operate steadily on a vast scale. In this connection, it is said that the French Company's securities are sold in increasing amounts in the "over-the-counter," or unlisted securities market of New York. This over-the-counter market for stocks has grown greatly in recent years, and is now rather firmly controlled by the Unlisted Dealers' Association, a responsible organization actively interested in preventing abuses in sales of securities. Many stocks of the highest investment caliber, such as the shares of the New York banks, are sold chiefly in this market. Thus it is active, "liquid," and its best securities possess a certain collateral value at the banks. Still another organization is the Lefcourt Realty Corporation, whose stocks are listed on the New York Curb. It, however, does not do its own construction or its own architecture. Shreve & Lamb are the architects for its latest great building, the 38-story office building located on the corner of Fifth Avenue and 43rd Street. In this building THE ARCHITECTURAL FORUM has its new home, in company with other technical and business magazines. Here is still another illustration of the merger movement.

Finally, it may be pertinent to point to the fact that the conventional type of mortgage bond issue has for several years attracted Wall Street investment houses. A number of them have floated some of the largest issues. A typical case is G. L. Ohrstrom & Company, a house active in public utility issues. In its real estate financing, G. L. Ohrstrom has limited itself to office buildings. On the other hand, several of the conventional mortgage bond companies, which formerly specialized almost exclusively in real estate issues, have gone more and more into general security issues. An example is S. W. Straus & Company, whose Fifth Avenue building bears this lettering: "Straus National Bank & Trust Company."

Such is the brief record of a number of interesting developments which may, or may not, indicate a new economic trend in the building world. Time alone can tell the outcome. In any case, the architect should view the movement from two sides. One is the possible effect on the building industry and on architecture, as a whole; the other is the effect on himself. As to the latter, the individual architect is doubtless his own best judge. Let him be prepared for any changes that may come. And as to the former, architects should try to realize (1) the enormous stimulus to building which should result from the greatly reduced costs possible in large-scale operation, in the method of "public" financing, and in the greatly reduced cost of operating buildings in large developments comprising a city block or more; (2) the higher architectural standards incident to long-term security issues; (3) economic stability of large-scale operation to the construction industry; (4) better standards of architecture.

There is, of course, no guarantee of these benefits, but it may be well for architects to lend their influence in the direction of progress and, if the new movement spreads throughout the industry, to do all they can to see that it is rightly handled and kept in strong, responsible hands. Otherwise its effects on the industry might be disastrous.

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THE SEVERITY OF FIRES IN BUILDINGS

BY

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ONE of the main objects of public regulation of building construction is to prevent undue hazard to life and neighboring property from fire. Fire exposure arises from interior and exterior origins. The evaluation of the exterior exposure can be done only with difficulty in quantitative terms, and the gradual accumulation of data from actual fires will probably continue as the main guidance in providing the proper protection. The present paper will deal mainly with methods of gauging the severity of fires resulting from the burning out of the contents of buildings whose walls, floors and column constructions are sufficiently fire-resistive to be capable of withstanding a complete burning out of the buildings' contents without collapse of major parts. It is only when the problem is thus restricted that there is much possibility of obtaining experimentally quantitative information pertinent to the answer sought. The severity of fires completely consuming the combustibles of frame buildings and masonry-walled buildings with combustible interior construction is of interest mainly as it concerns the exposure to adjacent or neighboring buildings and the fire exposure on party and fire walls and on record containers. As it concerns the severity of fires in buildings with interior combustible construction protected with incombustible floor, ceiling and wall finishes, the present discussion will apply up to the limit set by the fire resistance of these protections.

The Standard Fire Test and Building Fires. Indications of the intensity of building fires have been obtained from fused metals and from general fire effects on materials, on the reaction of which to temperature or fire exposure, such as in test fires, information is available. The fire ruins or reports of fires give, however, little information on the duration of the temperatures in a given portion of a building. The absence of data indicating how forms of construction or devices giving a certain record of performance in the standard fire test to be applied as protection against fire conditions in buildings with as much precision as results of strength tests are applied for load-carrying purposes, led me to consider the possibility of conducting burning-out tests in suitably designed structures to obtain the needed information. If such tests could be made to yield quantitative information on the equivalent fire durations to be expected with given building types and occupancies, it would help matters measurably to place the whole matter of fire-resistance requirements on a rational basis. Fire is a contingent condition that may or may not involve a building or given portion thereof in its lifetime. In theory, at least, the owner should be required to make provision for safety to life within and near the building and for protection to adjacent and neighboring property, only as it concerns the building type and size proposed and the type of occupancy for which it is intended. With requirements more or less uniform for all occupancies, the tendency would be to require more than the needed protection for buildings with the lighter occupancies from the fire hazard standpoint, and not enough for those with greater proportions of combustible contents.

Test Structures and Testing Methods. The first building, erected in 1922, was a one-story brick

Fig. 1. Interior View of Large Building Before Test With Office Occupancy

Fig. 2. View of Large Building During Test With Office Occupancy

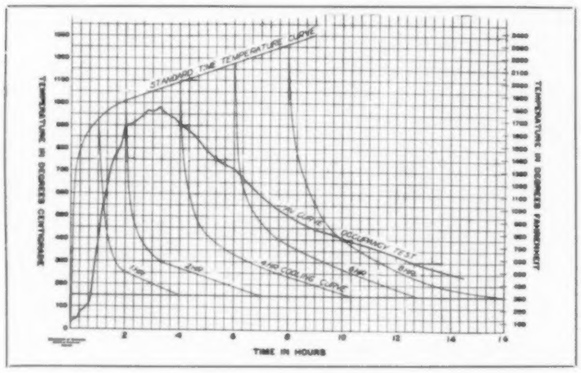

Fig. 3. Standard Furnace Exposure Cooling Curves and Curve From Occupancy Test

and concrete structure, 15 by 29 feet inside and about 9 feet in its dimensions from floor to ceiling without finish. This was filled with discarded furniture and records to simulate an office or light commercial occupancy, a wood top floor on sleepers in cinder fill being provided in some of the tests. The fire was started either in a waste paper basket placed near one of the desks or it was given what approximated an exposure fire start by burning a quantity of oil-soaked wood kindling in a grate about 3 feet in diameter and 7 feet high placed in one corner of the room. A metal shield around it was withdrawn when the contents were burning freely, the temperatures from the resulting hot blast being above the ignition points of wood and paper over most portions of the room. Pivoted shutters in the walls were regulated to give what was deemed to be the proper amount of air for maximum fire conditions within the room. Three tests with wood furniture and records, giving combustible contents inclusive of the wood floor, if present, from 13.1 to 15.4 pounds per square foot (Table 1), were conducted in this building, and also one test with records on wood shelving giving 55.4 pounds per square foot. The tests with office and records occupancy were repeated in a larger building, 30 by 60 feet in plan, with a monitor over the center section to provide draft conditions similar to those produced by an open stair or elevator shaft. This room was deemed to be of a size sufficient to account for

TABLE 1
RESULTS OF FIRE INTENSITY-DURATION TESTS WITH OFFICE AND RECORD ROOM OCCUPANCIES

Occupancy	Furniture	Finish floor	Building	Fire start	Amount combustible materials			Equivalent fire duration		
					Lbs. per sq. ft.	Approx. B.t.u. per sq. ft. of floor area	Approx. B.t.u. per cu. ft. of room volume	150°C. base Hr.-Min.	300°C. base Hr.-Min.	Curve used
Office	Wood desks, files, etc.	Wood	Small	Exposure	14.8	120,000	13,100	1 – 03	0 – 47	Average
Office	Wood desks, files, etc.	Wood	Small	Slow	15.4	121,000	13,200	1 – 26	1 – 15	Average
Office	Wood desks, files, etc.	Cement	Small	Exposure	13.1	105,000	11,500	1 – 05	0 – 54	Average
Office	Wood desks, files, etc.	Wood	Large, E. section	Slow	20.6	166,000	15,800	2 – 05	1 – 51	Average
Office	Wood desks, files, etc.	Wood	Large middle section	Exposure	16.3	132,000	11,300	2 – 01	1 – 49	Average
Office	Wood desks, files, etc.	Wood	Large W. section	Exposure	20.2	162,000	15,400	2 – 04	1 – 51	Average
Office	Steel desks, files, etc.	Wood	Small	Exposure	10.0	76,900	8,400	0 – 04	0 – 01	Average
Office	Steel desks, files, etc.	Wood	Small	Exposure	10.0	76,900	8,400	0 – 09	0 – 05	Upper
Office	Steel desks, files, etc.	Wood	Small	Exposure	12.0	87,000	9,500	0 – 35	0 – 02	Average
Office	Steel desks, files etc.	Wood	Small	Exposure	12.0	87,000	9,500	0 – 48	0 – 11	Upper
Record room	Wood shelving	Cement	Large, E. section	Slow	44.0	347,000	33,000	5 – 10	3 – 17	Average
Record room	Wood shelving	Cement	Large middle section	Exposure	52.2	411,000	35,400	6 – 57	5 – 00	Average
Record room	Wood shelving	Cement	Large W. section	Exposure	49.0	386,000	36,800	8 – 14	6 – 21	Average
Record room	Wood shelving	Cement	Small	Exposure	55.4	440,000	48,000	8 – 44	6 – 50	Average
Record room	Skeleton type steel shelving	Cement	Small	Slow	48.5	350,000	38,100	5 – 15	4 – 40	Average
Record room	Partitioned type steel shelving	Cement	Small	Exposure	49.2	333,000	36,400	5 – 00	3 – 41	Average

the effect on the fire severity attributable to room area. A view within this room before test is shown in Fig. 1, and one during a fire test in Fig. 2. The fires were started at one or more points in one (the east) end of this room, the large room size rendering it impractical to attempt an exposure start for the fire as was done in the smaller room. However, as it concerns the middle and farther (the west) section of this room, the fire start can be regarded as equivalent to exposure from the burning of the contents of the section in which the fire originated. Air temperatures were measured at three levels; measurements were also made of temperatures in the debris. In the smaller room between 35 and 40 thermocouples were used for these purposes; in the other about 100.

Heat of Combustion of Contents. Besides listing the combustible contents in pounds per square foot, the heat value of the contents is also given in Table 1 in terms of British thermal units per square foot of floor area and per cubic foot of room volume. The heat of combustion of the wood and paper constituting the contents was determined in tests on typical samples.

Reduction of Temperature Data. From the temperatures at the different points in the room the average for the room or a given section thereof is obtained, which, together with the corresponding maximum and minimum temperatures, is plotted against time as abscissa. The data are also reduced to show the average temperatures at the different levels. As a rule, only the average room or section temperature is used in the comparisons to obtain the equivalent fire durations. In the case of the tests with office occupancy and steel furniture, the average temperature for the upper level, 18 inches below the ceiling, was also used.

The standard furnace exposure curve used generally in American fire-testing practice, together with cooling curves obtained from temperature measurements of our furnace chambers after the fire was shut off, are shown in Fig. 3. There is also given in Fig. 3 the average temperature curve from one of the burning-out tests. An approximate comparative measure of severity is obtained by assuming that the area under the latter curve, expressed in degree-hours, gives severity equivalent to an equal area under the standard exposure curve and the cooling curve applicable for the given period. The assumption that equal areas under time-temperature fire exposure curves stand for equivalent severity of exposure is an approximation only, since in the heat conductivity equation applicable for the case, the exposing temperature enters directly as a factor in the expression for the temperature obtaining at any point within an exposed body, while the time, which is the other factor in the time-temperature area, enters as an exponent. However, we have

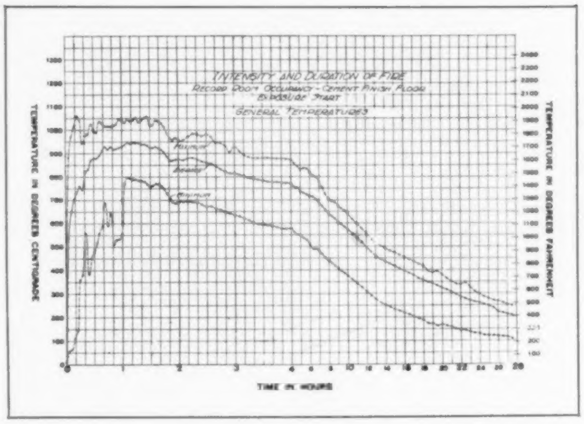

Fig. 4. Time-Temperature Curves From Record Storage Test With Wood Shelving in Small House

so far found no better measure of comparison than this that can be conveniently applied. It might also be noted that temperature transmission through materials is retarded not only by the heat insulating properties present but also by calcination effects and evaporation of free and combined water, and it appears probable that the effect of the fire exposure in breaking down resistance of the latter type is also measured approximately by the product of exposing temperatures and the time they prevail.

Another point that must be considered in making such comparisons is the minimum temperature that need be considered as an exposing temperature. For the results reported here, 150° C. (302° Fahr.) and 300° C. (662° Fahr.) have been taken as base lines, and only the areas of standard and occupancy test curves above these lines are considered significant. The former is below the ignition points of ordinary combustible materials, and it would not in any general case appear necessary to take into account lower temperatures, even considering that temperatures somewhat higher than the average room temperatures used in the comparison obtain in portions of the room. Where only protection for incombustible structural members is involved, temperatures below 300° C. (662° Fahr.) can probably be neglected where the fire exposures are of the relatively short durations incident to fires in buildings. To make convenient the determination of equivalent durations from burning-out tests, the area to a given base line under the standard furnace curve plus cooling curve, expressed in degree-hours, is plotted against time as abscissa. The area, to the same base line of the time-temperature curve from the occupancy burning-out test considered, is obtained in the same unit, and the equivalent duration of the latter can be read directly from the area-time curve of the standard furnace test.

Details of Tests and Results. All tests from which results were obtained in the form of equiv-

Fig. 5. Office Occupancy With Metal Furniture Before Test

alent fire durations, are given in Table 1 (page 776).

Office Occupancy; Wood Furniture. As already indicated, three tests of office occupancy with wood furniture were made in the small structure and a similar test with a somewhat larger amount of combustible contents in the larger building. As it concerns equivalent fire durations, the results of the latter test are reported separately for each of three 20-foot sections in the 60-foot structure. These fires resulted in complete burning of contents, including the wood finish floor where present. Time-temperature curves from one test are shown in Fig. 4. The larger room area gave a little greater severity than would be expected from the results of tests in the smaller room, even after allowing for the difference in amounts of combustible contents present. The fire in the end sections of the large building apparently affected the temperatures in the middle section to such an extent as to give it nearly the same equivalent fire duration in spite of the lower content. The vent over the middle section induced air currents that undoubtedly aided in equalizing the room temperatures.

Office Occupancy; Metal Furniture. These tests were conducted in the small building, the furniture consisting of desks, tables, filing cabinets and shelves similar in number and disposition to what was present in the tests with wood furniture (Fig. 5). The total quantity of records was, however, greater by about 25 per cent, and about one half of it was placed on top of tables or in open shelves or cabinets. With cement finish floor no room temperatures above 104° C. (219° Fahr.) developed when fires were started from burning contents of waste paper baskets. The fire was confined to the contents of the open shelves and to other exposed paper adjacent to the origin. With a wood finish floor and a start for the fire in a pile of waste paper, contents of adjacent open shelves and of filing cabinets under which the floor burned out were wholly or partly consumed. The progress of the fire was very slow, 8 hours being required before 30 per cent of the floor was consumed. The maximum room temperatures at the different points ranged from 50 to 230° C. (122 to 446° Fahr.), and except for the slow fire in the finish floor, no general spread of fire occurred.

Two exposure starts for the fire were staged, one with a cement finish floor and one with a wood top floor. In the former, exposed paper over about two thirds of the room was ignited by the blast from the grate, but no general fire

Fig. 6. Metal Furniture on Wood Floor After a Fire With Exposure Start

condition involving the room contents developed. Temperature maximums from 55 to 808° C. (131 to 1,486° Fahr.) were recorded for different portions of the room, most of the heat developed being from the fuel in the grate. At the end of 30 minutes, the temperature maximums were generally below points causing ignition of combustible materials. The highest equivalent duration obtainable from this test was 9 minutes, which was obtained from the curve for the upper level, 18 inches below the ceiling. After the exposure start with wood finish floor, about the same extent of initial spread of fire occurred as in that with cement finish floor. The fire in the wood floor progressed more rapidly than with the slow start for the fire, being about 20 inches from the opposite end of the room at 4 hours, when the fire was put out. Average room temperatures above the ignition point of paper obtained for most of this period. The equivalent fire durations (Table 1) range from 2 minutes to 48 minutes, depending on the base line and the temperature curve taken.

Record Room Occupancy; Wood Shelving. One test was conducted in the large building with records on wood shelving, the combustible weight being from 44 to 52.2 pounds per square foot assumed to be uniformly distributed. This followed a previous similar test in the small building with records and shelving weighing 55.4 pounds per square foot. The latter was given an exposure start from the grate, the equivalent durations being longer than for any other test. The results for the east section of the large house cannot be considered fully valid on account of the irregularities involved in starting the fire from a single small origin in this section. The wood shelving in these tests collapsed within one hour after the fire was burning freely, precipitating the paper contents in a mass which burned slowly.

Record Room Occupancy; Metal Shelving. The long equivalent durations obtaining for the tests with records on wood shelving prompted inquiry into methods whereby the hazard can be reduced, which led to tests with metal shelving. The results with wood shelving indicated that the building members adjacent to such concentrations would require heavier protection than those for the portions of the building housing the regular office occupancy as such. Inasmuch as these concentrations may occur anywhere within the building, the general design would have to take them into account, if fires completely consuming them without any fire extinguishment are to be premised. The tests with records on metal shelving

Fig. 7. Metal Shelving, Backed and Partitioned Type, Before Fire Test

were all conducted in the small building, the weight of records, assumed uniformly distributed, being 48.5 pounds per square foot of floor area, which was the same as was present in the previous test in the same building with records on wood shelving. No wood top floor was present in any of the tests with "record room" occupancy. In the first tests, shelving representative of several general types was introduced, nearly one half of the records being on "skeleton" type shelves having no partitions or backs. Others had partitions but no backs, or else backs without partitions, and one single-depth, 29-foot row had both backs and partitions, with doors on two 3-foot-wide sections.

The first of these tests was started with a waste paper basket fire in front of a single-depth bay open at the front, but with metal back and partitions. The window shutters were opened to give the air supply deemed most favorable for fire spread, but no general fire condition resulted, the fire when put out after 7 hours, 20 minutes, being confined to two 3-foot sections with some charred or glowing papers in a cupboard adjacent to one of them. The affected paper was replaced, and two fires were started simultaneously in piles of waste paper placed on the floor,—one in front of shelving similar to that used in the first trial, and the other in front of a double-depth "skeleton" row. The fire progressed more rapidly than in the first test, particularly in the open shelving, and at the end of 1½ hours the whole room was involved. Collapse of skeleton-type shelving began at this time and eventually involved all of the shelving that did not have partitions. All combustible contents of the room were completely consumed, the equivalent duration of the fire being 5 hours, 15 minutes as derived for the 150° C. base and 4 hours, 40 minutes for the 300° C. base.

The room was fitted with new shelving, mainly of the backed and partitioned type with doors every third bay. Three double bays of well braced skeleton type shelving were also included. In one test with a slow start for the fire, made in a manner similar to that of the first test already described, the fire progressed laterally through a 3-foot wide cupboard section and another 3-foot wide section with open front in 20 hours, but no general fire spread resulted. A second fire in front of a double-depth, open-front, backed and partitioned bay, spread through a closed front section on each side and involved the whole 18-foot wide stack in about 9½ hours. In this test the window shutters were kept at the lowest opening, and while this retarded the fire at some stages, it enabled room temperatures to be built up high enough to cause general fire spread at 13½ hours.

The room was reloaded for tests with "exposure" start for the fire, approximated as in the previous tests by starting a fire in oil-soaked wood kindling in the grate in one corner of the room. After withdrawing the surrounding shield when the kindling was burning freely, the resulting air temperatures in most portions of the room were above the ignition point of paper for from 10 to 15 minutes. While fires started at many points, they did not progress, and after 2 hours the average room temperature was below 100° C. Similar results were obtained in a second exposure start. After one hour the window shutters were closed to their lowest opening, and the fires which had started in various portions of the room were allowed to go on until air temperatures high enough to cause general fire spread were built up.

TABLE 2
EQUIVALENT FIRE DURATIONS FOR OFFICE AND RECORD ROOM OCCUPANCIES IN FIRE RESISTIVE BUILDINGS EQUIPPED WITH COMBUSTIBLE FURNITURE AND SHELVING

Total combustible content (Inclusive of finish floors and trim)		Equivalent fire duration	
Lbs. per sq. ft.	Assumed B.t.u. per sq. ft.	Hrs.	Min.
10	80,000	1	00
15	120,000	1	30
20	160,000	2	00
30	240,000	3	00
40	320,000	4	30
50	380,000	6	00
60	432,000	7	30

This required about 4 hours, the fire in the skeleton bays being mainly responsible for the relatively rapid temperature rise. The contents of the whole room were soon involved, the fire being quite intense but of shorter duration than in previous tests with record room occupancy. No collapse of shelving supports from fire exposure occurred during this test, most of the contents remaining on the shelves until consumed (Fig. 8). The equivalent duration of the fire (Table 1) was 5 hours, computed to a base of 150° C., and 3 hours, 41 minutes computed to the 300° C. base.

Temperatures in the Debris. The temperatures and equivalent fire durations so far discussed are based on free air temperatures and do not consider those in the glowing or hot debris on the floors after the fire. Measurements of such temperatures were made at three or more points in the different tests. For office occupancy with wood or metal furniture, these temperatures were indicated to give a more severe exposure than the air temperatures only where extra high cabinets of considerable area were present. Insulated safes, having fire resistance of little above 1 hour as referred to the standard fire test and placed closely adjacent to four-drawer wood filing cabinets in the burning-out tests, satisfactorily preserved their contents. However, the depth of the debris from some of the large stacks of shelves or cupboards 6 feet high, present in the office occupancy test in the large house as well as the temperatures measured in it, indicated a more severe exposure than the air temperatures developed. The depth of the debris and duration of high temperatures were even greater for record room occupancy and wood shelving, average temperatures of 300° C. (572° Fahr.) or over obtaining for periods of up to 16 hours. For the test with records on the skeleton-type shelving that collapsed, the debris temperatures indicated a condition only slightly more severe than the air temperatures, and for the last test with steel shelving that did not collapse, the debris or floor temperatures gave a duration about the same as that for the air temperatures computed for the 150° C. base and very much lower (1 hour, 46 minutes) for the 300° C. base.

Fig. 8. Metal Shelving, Backed and Partitioned Type, After Fire Test

TABLE 3
EQUIVALENT FIRE DURATIONS FOR OFFICE AND RECORD ROOM OCCUPANCIES IN FIRE RESISTIVE BUILDINGS EQUIPPED WITH INCOMBUSTIBLE FURNITURE AND SHELVING

Occupancy	Furniture	Finish floor	Total combustible content, (Inclusive of any wood floor and trim)		Equivalent fire duration	
			Lbs. per sq. ft.	Assumed B.t.u. per sq. ft.	hrs.	min.
Office	Incombustible filing cabinets, desks, shelves	Incombustible	10	74,000	0	10
Office	Incombustible filing cabinets, desks, shelves	Combustible	12	91,200	0	30
Record room	Incombustible open shelving	Incombustible	50	350,000	5	00
Record room	Incombustible partitioned and backed shelving	Incombustible	50	350,000	4	30

While these temperatures indicate the desirability of not placing safes and similar containers in close proximity to high concentrations of combustible materials, the heat effects from the debris will be mainly on the floor construction. Since as a rule there are no combustible materials or finishes on the ceiling side of floor construction, higher temperatures can be permitted than for walls and partitions protecting combustible materials in contact with the unexposed side. This consideration, together with the fact that water

will generally be applied on the debris from such concentrations, apparently justifies the basing of fire-resistance requirements on fire durations derived from measurements of the air temperature of the room rather than from those of the debris.

Summary and Conclusion. The equivalent durations given in Table 2 for assumed amounts of combustible contents are based on the results given in Table 1 for office and record room occupancies employing wood furniture and shelving. The periods given are intermediate between those obtaining for the 150 and the 500° C. base, being possibly a little closer to the former than the latter. The periods for the 30 and the 40 pounds per square foot of combustible content are derived by interpolation between the results with office occupancy on one side and with record room on the other. There is also a little extrapolation involved in connection with the periods for the 10 and the 60 pounds per square foot floor load. The heat of combustion of the contents is taken at 8,000 B.t.u. per pound up to 40 pounds per square foot combustible content, beyond which it is decreased to 7,600 and 7,200 B.t.u. per pound for the 50- and 60-pound floor load, to allow for the relatively greater amount of paper entering into the contents.

To judge by the trend of the experimental data, the one-hour equivalent duration for 10 pounds per square foot combustible content is a little higher than indicated by the tests. The periods for the 15- and 20-pound load are, however, near the average of experimental values. The small margin for the lowest period is considered desirable, since with low room contents the increase in severity from exterior exposure and similar fire effects would be relatively more pronounced than for rooms with a greater amount of combustible contents. The periods as they stand contain an element of exposure of the amount obtainable from the equipment used to produce an exposure for the fire in the tests. The periods given in Table 2 for 50 and 60 pounds per square foot content appear a little low as judged by the weight of contents alone. In the tests with records on wood shelving, the contents were mainly old government account records on grades of paper that had a higher fuel value than can be premised for the paper that generally constitutes the contents of record rooms. Hence in Table 2 a somewhat lower B.t.u. value is assumed for the contents than obtained for the paper in the tests with record rooms, and on the basis of these assumed values, the equivalent durations given will be found to accord with the results of the tests.

The periods for office and record room occupancies with metal furniture and shelving given in Table 3 are obtained directly from Table 1, from the tests with comparable equipment and combustible contents. For office occupancy with cement finish floor, the value in Table 3 is a little above the maximum obtaining at the upper level in the burning-out test with exposure start for the fire. The other periods are chosen to include allowance for exposure start for the fire comparable with what was done in deriving periods in Table 2.

Application to Other Occupancies. The equivalent fire durations summarized in Tables 2 and 3 apply in the main to light commercial, office or record storage occupancies where the combustible materials are principally wood and paper. The extent to which the results of these tests can be applied to other occupancies depends on the character of the combustible materials housed and their calorific values as compared with those for wood and paper. In Table 4 are given the calorific values for most materials or material-forming substances that are housed in buildings. These were compiled mainly from printed matter on the subject. Determinations were made on wood and paper present in the tests and on some fibrous organic materials. In addition to the calorific value, the readiness with which a given material burns would also have to be considered. It is intended to conduct some tests in the near future to obtain information on the effect of such variations on resulting equivalent fire durations. It will be seen from the table that a considerable number of materials have calorific values within the range given for wood and paper. It appears probable that for occupancies housing such materials, and possibly for some that have properites outside of this range but with burning properties not too far different from wood and paper, a fair approximation of the equivalent fire durations to be expected can be obtained by applying the B.t.u. values and corresponding equivalent fire durations given in this paper.

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THE SUPERVISION OF CONSTRUCTION OPERATIONS

BY

WILFRED W. BEACH

CHAPTER 5, BEGINNING THE WORK—(CONTINUED)

Editor's Note. In the April issue Mr. Beach gave an interesting and instructive account of the architect's superintendent's "First Day on the Job." He also began Chapter 5, entitled, "Beginning the Work," continued here. In this issue of THE ARCHITECTURAL FORUM, *Mr. Beach also takes up Chapter 6, "Contract Charges," and shows the problems that arise and the part the superintendent must play in their solution. The article in the April issue quoted paragraphs from the specifications regarding storm water and pumping.*

In consideration of the provisions in these clauses, the superintendent suggested that, inasmuch as the general contractor was obligated to continue to keep the excavation free from water after his subcontractor had finished excavating, the general foreman would be justified in getting a power pump and putting it to work, leaving the question as to who would pay for this emergency pumping to be settled next day, when the general contractor would be present to give his views. It was so arranged, and a gasolene-driven pump was at work before the downpour had ceased. The grounds were too wet for other operations, and the foreman intimated that they would be justified in asking for credit for a day's delay, under the clause in the specifications appertaining to such an event. This is "Art. 18. Delays and Extension of Time" of the General Conditions of the American Institute of Architects and provides that "if the Contractor be delayed . . . by any causes beyond the Contractor's control . . . then the time of completion shall be extended for such reasonable time as the Architect may decide." But it further stipulates that "no such extension shall be made for delay occurring more than seven days before claim therefor is made in writing to the Architect."

The superintendent admitted the validity of the claim and cautioned the foreman that it must be made to the architect in writing, but the foreman preferred to leave this formality to the contractor who was expected back the next day. Here the superintendent took occasion to advise the foreman that, in the absence of his employer, the general foreman was supposed to be in charge, and that he should have a more distinct understanding as to the amount of authority vested in him. This is clearly set forth Art. 14 of the General Conditions just quoted. It is most important that a general foreman be made to realize that he is possessed of adequate authority for full conduct of the work at all times when the contractor cannot give it personal attention. If this is not insisted upon and made clear at the start, the superintendent is likely to be frequently rebuffed with the statement that this, that or the other thing must await the decision of the contractor, either by mail or at the time of his next visit,—the while the work goes on, and the issue may be dodged or forgotten.

Under such conditions the superintendent may eventually find himself doing the work of the general foreman,—perhaps with full approval of the contractor, who is thereby saving the additional wage of a more competent foreman, and asserting meanwhile that a better man is not available or that a new man might "ball things up." "The job is going satisfactorily all 'round, isn't it? What more can one want?" "It's dangerous to change horses in the middle of a stream," etc. Such a situation arrives with imperceptible advances and is extremely dangerous. The superintendent is assuming responsibility which may seriously react upon his employer and for which he is not being remunerated.

A case in point is that of a superintendent who had acquired the habit of doing little things for a backward foreman on a residence alteration. Arriving at the house late one morning on his regular round, he saw men standing idle, waiting for flooring, and no foreman in sight. He telephoned the lumber yard and demanded:

"How about that oak flooring for the Smith job?"

"Are you talking for Edwards & Henry?" was the rejoinder.

"For their foreman, yes."

"Well, we're glad to know you're ready for it. First we've heard. Send it right up."

"All right; hop to it. The men are waiting."

"Sure. It'll be there right after lunch."

Now, the superintendent didn't know, or didn't think, about the big Smith apartment house being built under another architect by the same contractors, who called *it* the "Smith job" and the smaller contract, the "J. T. Smith alterations." The unfortunate superintendent had inadvertently ordered all the flooring for a 75-apartment building, a rush job. Truckload after truckload filed out there during the afternoon, before the shipment could be countermanded, only to find the plastering unfinished and no place to unload.

When the sleepy foreman awakened and began to inquire for *his* flooring, the mess was untangled,—at a cost for hauling and handling of $160, which was assessed against J. T. Smith's architect. In vain did the superintendent contend that the same mistake *might* have occurred if the foreman had done his own telephoning. There was no escaping the fact of who had ordered the flooring. Thereafter, one superintendent was much more discreet in the performance of duties other than his own. His telephone demand should have been made to the office of the contractors,—not to the yard.

On Tuesday morning, the architect and contractor were both on hand at the school building, which we are discussing, and the subcontractor at once brought up the question as to who was to pay for the pumping just mentioned. Of course the general contractor insisted that it was included in the excavating, as it should have been according to the specifications,—but he could not swear that the excavator had seen the specifications. Appeal was made to the architect, who called the superintendent aside to discuss particulars, remarking that it appeared that the contractor was "stuck" because he had been careless in letting an oral contract, albeit on a written bid. But the superintendent had discovered that the excavator had a pumping outfit and had expected to use it, hence his contention was in the nature of a bluff, fairly well founded. The architect thereupon advised the contestants that, under the contract, it was distinctly not his business to interfere between a contractor and his "sub" but that, if they cared to leave the matter to the superintendent as an arbitrator, he would permit him to render a decision. After discussion with his foreman, the contractor acceded to this, as did the excavator. The superintendent made his acceptance of the office of arbitrator conditioned upon their further agreement to abide by his decision when rendered, not because it was his function nor that of the architect to act in this capacity, but purely for the sake of amicable procedure. With this assurance, he decreed that, inasmuch as it was essential that the excavation be kept free from water in order that the steam shovel could work efficiently, as well as to enable the general contractor to dig his footing trenches and pour his concrete, and that this contingency was fully covered in the specifications (by which, if it came to a showdown, the subcontractor must be bound or vacate the premises), and whereas both contractor and subcontractor were equally remiss in the failure of the latter to read that portion of the specifications in which he was particularly interested, it therefore appeared most fair that, so long as the subcontractor and his men remained in the excavation, he and the general contractor should share equally in the expense of keeping the water out. Everybody appeared satisfied, including two members of the board who had appeared during the discussion.

The general foreman then raised the question of a time allowance for loss of the preceding day, of which the contractor made note and said a letter would be sent the architect on the subject from the contractor's office next day. This caused a suggestion from the superintendent to the effect that there should be specific understanding all around that the foreman possessed the necessary authority to handle all matters demanding prompt action, in the absence of his employer. In this he was warmly seconded by the architect, who pointed out that this contract plainly called for a foreman competent to have such dependence placed in him, adding that copies of such orders as the foreman might issue or accept should be in his home office next day to be checked up. Such was therefore made the general understanding.

CHAPTER 6

CONTRACT CHANGES

EVERY superintendent of experience has learned to appreciate the joy of seeing a "no-change" building contract carried to completion and, conversely, to dread changes, at least to a degree that will impel him to make use of every safeguard to avoid having trouble and entanglements follow in the wake of such changes. In this, he has the specific mandates of the specifications to support him. (Arts. 15 and 16 of the General Conditions of the American Institute of Architects.)

One of his duties is to see that these provisions are closely adhered to, both by his own home office and by the contractors. One absolute and inviolable rule must be that no departure of any character, no matter how seemingly trivial, from a strict interpretation of the terms of the contract will be permitted, unless covered by a formal change order. This is one of the most important of a superintendent's inhibitions, yet it is one too much abused by men whose experience should have taught them the peril of laxity in this particular. It is easy to say "Yes, it will be just as well to do it that way," or "Stick in a half-dozen extra rods there; we can save them somewhere else," etc. But it is only a short step from such

offhand procedure to carelessness in more important matters. The only wise course is to make strict adherence to due formality the positive rule, from which there are to be no exceptions. This applies not only to orders emanating from the architect and superintendent but to the owner's instructions as well. The latter should be prevented, to such extent as can be diplomatically effected, from doing or saying anything to any contractor or employe on a building that may be construed as authority to do something at variance with contract stipulations. Ordinarily, an owner with average intelligence or common business sense can readily see the purpose of this, or will quickly be brought to appreciate it, if explained. Such explanation should not be withheld on the assumption that it is the owner who foots the bills, that he is fully of age, and hence should be permitted to do as he pleases with his own. One who does so to the extent of interfering with the proper execution of his contract is likely, later on, to claim in defense that the architect was employed to keep the owner from getting into trouble but did not use adequate measures. Such an owner should be held in restraint, if possible. He may carry his officiousness so far as to ultimately induce an allegation on the part of the contractor (as in a particular example) that the terms of his contract had been set aside *in toto* by reason of several orders from the owner. The admission by the owner of the validity of some of these orders once tended to establish the general contention of the contractor and provided a foundation on which he based a claim to several extras for which the owner had not anticipated any charge whatever.

One is naturally more formal in conducting the details of public work than in private matters; and one will commonly encounter fewer changes in work of a public nature. In operations for an individual client, the owner takes a closer personal interest and insists upon having things to his liking. If it be an alteration job, the number of changes may mount up rapidly, and one must watch every step, or the day of final reckoning may prove anything but a joyous holiday. If a superintendent can face such a day with the record of every extra and deduction "in plain black and white" and duly attested, he has no reason to worry, even if the number of such changes should reach a hundred or more,—as is quite possible.

The superintendent on our school building being considered in these articles had no intention of allowing any loose ends to drag at the beginning of his work and to later develop into sources of misunderstanding and disagreement. He therefore took note at this juncture of the fact that, although the steam shovel was in position to operate on Tuesday morning after the storm, it was not possible for the dump trucks to get around in the mud until later in the day. This was important in connection with the excavator's contention that further delay in decision on depth of the basement would cause him added expense. It was evident that no such claim could be established until all the excavating equipment could work to advantage.

The subject of this proposed change in height of grade at the building was therefore next in order for the attention of the architect when he came on the work Tuesday forenoon. In explanation of this proposed change, the reader is referred to the plot plan in Fig. 8. Datum was established at +100′ (marked "O" on the plot plan) and several other bench marks were permanently shown by incised crosses on the curb, so separated that an instrument could pick up at least one from any position. The bench mark on the curb at the head of Ash Street, opposite the center of the building on the north, was +117.00′. Natural grade around the building is shown by the plot plan to vary from +117.05′ at the northwest corner to + 111.15′ at the southeast corner. Finished grade at the building had been established at +118.00′ along the north front and at +116.00′ on the south, with short slopes connecting the two levels on the east and west ends; making a fill of nearly 5 feet at the southeast corner, tapering up to grade toward the north and west. To raise the grade 3 feet, as was proposed by the town planning commission, would have improved the commanding appearance of the north facade, as viewed from Ash Street, but the architect questioned the probable benefit as viewed from Orchard Street or other points to the south, as the building was already sufficiently high for that prospect, in his estimation. He did see a possible advantage to be gained by increasing the height of the basement windows, in case the grade on the south were left 4 feet lower than the north, in place of the 2-foot difference shown by the drawings. The west wing of the basement was given over to toilet and bath rooms, including a swimming pool, the center section to laboratories and rooms for the school dentist and nurse, while the east wing was devoted to the heating plant and storage. There were no windows provided on the north side of the basement, as the main floor was only 1 foot, 9 inches (three steps) above grade.

Apparently, the only serious objection to the change was that the bearing capacity of the underlying soil would probably not be so good at the higher level. This would have to be investigated, —possibly tests made. The area of the building was 21,050 square feet, and the area to be excavated (2 feet larger all around than the outside

dimensions of the basement walls) was 23,006 square feet. The entire excavation totaled 11,438 cubic yards. Each foot of rise of the building would save 852 cubic yards of excavating, or 2,556 cubic yards if the building were raised 3 feet. It developed, in the course of conversation with board members who were visiting the site, that one of the local unsuccessful bidders had said that the district could save over $1,000 for every foot the building was elevated, and hence the board was counting on a saving of at least $3,000 by making the change. The architect took the subject under advisement and promised to have a report ready for decision at the called meeting of the board that afternoon.

In discussion with the general contractor and his subcontractor for excavating, the architect learned that the contract price for this branch of the work was $7,400, or about 65 cents per cubic yard, and hence the saving for the 3 feet of excavating could not apparently exceed $1,660.40. But even this amount of saving was denied by the "sub," who divulged the fact that he was getting $1 a yard for the earth he had contracted to haul to a certain low lot; that he expected to use all his surplus in this manner, and that it netted him a profit of about 37½ cents a yard, which he stood to lose if the 2,556 yards were taken away from him. He said his competitors were sore at him because they had fixed $1.15 a yard as the price to be used on the school job, and that they were undoubtedly back of the attempt to reduce the amount of his work and cut his profits accordingly. The deduction of 2,556 cubic yards would take away almost one-fourth of his work, and he felt that he was entitled to the profits he had anticipated, regardless of the amount of material eventually moved, especially as he had been the means of saving the district considerable money.

It is thus evident that contract changes may be much more involved than merely the deduction or addition of so many units at a known cost price, plus overhead. In many trades, they are not so readily computed. In this case there were several factors to be considered, and it was also evident to the architect that local jealousies were beginning to appear and would have to be reckoned with. He had learned that the board member who was on the town planning commission was a brother-in-law of an architect, one of the losing competitors for this particular work, and hence this board member could be expected to introduce embarrassing issues whenever opportunity offered. In order to be sure of his ground in this case, the architect secured a sworn copy of the grading contractor's bid and was also able to get a copy of a bid by another grader which ran nearly twice as high. He then carefully computed the various quantities of excavating and fill and paid a visit to the lot to be filled and to its owner. The latter confirmed the price to be paid for the earth. He could not use more than 1,200 yards, whereas the contractor had to take out about 5,500 yards more than he could use on the premises. He would therefore still have about 1,800 yards to dispose of, if he were to submit to a deduction of 2,556 yards. It appeared doubtful if he would find any better place to dump it than on the lots south of the school property, where he could get nothing for it. The whole question thus resolved itself into these elements:—

1. To what extent were the contractor and his "sub" entitled to unearned or anticipated profits on such items as this when a deduction from the contract price was made?

2. What could be assumed to be the true anticipated profit of the subcontractor on the material he had hoped to sell?

3. If he were deprived of his sale price of $1 per yard on 2,556 cubic yards, what would that make the remainder of his excavating cost him per yard?

Answering the first of these, it is customary, in making deductions from a contract price (unless the items are *very* large), to deduct the computed net cost to the contractor without reducing his gross profits on the entire work, since those profits represent his interest in the whole transaction, the which is not lessened by the lopping off of minor items. Carried to a logical conclusion, this would appear to be true in the case of a subcontractor. The answers to the second and third queries were purely matters of conjecture. No definite evidence could be adduced as to the exact cost of the work per yard, since the contract included subsequent backfill and grading; but, for his own information, the architect set up some actual and some empirical figures:—

6,000 yds. to be taken out and graded, @ 90¢	$5,400
5,438 yds. to be taken out and removed, @ $1.25	6,798
Total	$12,198
To be derived from sale of 5,438 yds., @ $1	5,438
Net cost of excavating and grading	6,760
Subcontractor's profit	676
Contract price	$7,436

If it were costing 90 cents a yard to take the material out and re-handle it, it was probably costing about 60 cents net for the general excavating, and would cost about 15 cents additional per yard to haul it across the road to the south.

Thus was derived a figure of 75 cents per yard, which the architect fixed upon as his unit of cost. Not so the excavating contractor. He and the contractor attended the meeting, and the former let it be known whence, in his opinion, had come the idea of the change, and he added that he did not propose to allow disgruntled competitors to interfere with the profits on work he had beaten them out of. He insisted that he would lose 37½ cents profit on each yard of filling material of which he was deprived, and therefore could allow only a deduction of what would remain after these anticipated profits had been deducted from his cost per cubic yard, which he was willing to assume at 75 cents a yard, as the architect had reckoned it. The general contractor said he would allow a deduction of whatever his "sub" would consent to, but that he could not allow any of his own profit to be forfeited in the change. Here there entered the school principal, who did not intend to keep in the background in such matters, and who had also been doing some figuring. He estimated the saving to be 2,340 cubic yards at $1.15 a yard or $2,691, to which he had added the contractor's profit, making $2,960, as his idea of what should be credited to the owner.

The excavator's figure was $958.50 for the 2,556 yards, but he demanded, also, that he be allowed $100 for the delay he had been caused by not being allowed to proceed at once to the contract depth. This the architect vetoed promptly, both because there had been no delay up to that time, except as due to the storm, and because if there had been a delay to the extent of resultant damage, it would accrue only by going to the lower depth, not if the building were kept up the 3 feet. He also explained the discrepancy in the estimate of the principal, which was evidently due to his having used the net area of the building instead of the gross area to be excavated. The architect further dwelt upon the saving that had been made for the district by virtue of the excavator's having taken the work at a price so much under the $1.15 unit, which could not therefore be used in these computations, nor did he see reason for the contractor's assumption that he should be reimbursed for a conjectured possible profit, of which he had no definite evidence. The architect declared it to be the policy of his office, that, after a contract was signed, the profit to the contractor was thereby fixed for the given work, not to be disturbed by later deductions. He saw no reason why this policy should not be extended to the benefit of the subcontractor in this instance, but insisted that it applied to actual net profits and not to hypothetical earnings. He estimated the net cost of taking out the material and disposing of it at the least expense to be 75 cents per cubic yard, and hence was prepared to issue the order for the change, of which he approved, at that rate, or a total deduction of $1,917. The members of the board saw plainly that the principal's estimate was at fault, and the contractor was able to convince his "sub" that he had best accept the architect's figure.

The change in grade was from +118.00′ to +121.00′ on the north and from +116.00′ to + 117.00′ on the south. This left 2 feet of additional wall exposed on the south and parts of the two ends, which called for about 5,000 extra face brick. The architect took advantage of the change to add 12 inches to the height of the glass in both the upper and lower sash of the basement windows. For these latter changes, the architect and general contractor had readily agreed upon an extra cost of $467, leaving a net deduction of $1,450 for the change. This the architect supplemented by warning the board that, as yet, there could be no definite assurance that the footings as designed would be adequate at the new level. This could not be established until the bottoms of the trenches could be inspected, perhaps tested for bearing capacity.

The board next took up for reconsideration the subject of restoring the tile partitions throughout the building and eliminating the wood lath that were to have been substituted under the contract.

The architect next presented the bond of the general contractor and those of the electric and heating contractors for acceptance, and inquired if the board had received one from the plumbing contractor, a local man. The latter was present and asked that the board approve a personal bond, a copy of which he submitted, naming two prominent men as his sureties. He offered to deduct $400 if the personal bond were accepted. The bond was passed over to the board's attorney, who said the form was "O.K." and handed it back with a question as to how much the other form would have cost, insisting that, if the personal bond were accepted, the district should receive full credit for the difference in cost of the two forms. The contractor admitted that a surety bond would cost 1½ per cent of his contract price (which was $54,000) or $810, the which he grudgingly agreed to allow and which the board unanimously voted to accept. The members appeared to have quite forgotten the advice of the superintendent anent personal bonds, hence neither he nor the architect joined in the discussion, though the latter had a report from the superintendent to the effect that the plumber's reputation in the community was none too good, the which had been confirmed by an adverse report from a plumbing supply house. The reason for the architect's reticence (which

greatly surprised his superintendent) was that the next bid was $7,200 higher and was that of a concern in the architect's home town, toward which he was known to be friendly. He noted that this local man had at least two sponsors on the board, one of whom was the lumber dealer. It was later learned that the latter held the plumber's note for $1,200, which the latter had promised to liquidate out of his first payment,—and did. It was a good time for the architect to wait until spoken to, considering the insinuation already voiced to the effect that he welcomed opportunities for increasing his fee through enlarged building costs.

The architect produced the change orders and presented them for signatures, he having anticipated the board's action on both matters. The first of these read:

CHANGE ORDER NO. 1.
CONSOLIDATED DISTRICT SCHOOL
EAST MILLVILLE, P.M.

Millville, P.M., Apr. 24, 1928

Mr. J. Q. Brown, Contractor,
Millville, P.M.

Dear Sir:—Referring to your contract of April 2, 1928, for the general construction of the East Millville Consolidated District School Building, you are hereby authorized to raise the established grade along the north front of the building from + 118′0″, *as shown on drawing, to* + 121′0″, *without increasing the cubic contents of building or walls. The grade along the south side will be raised from* + 116′0″ *to* + 117′0″, *thus increasing the exposed area of basement walls on south elevation and on portions of east and west elevations 2 vertical feet. The glass area and brick facings on these elevations will be correspondingly increased.*

For the saving in excavating due to the foregoing change, there will be deducted from your contract price the sum of nineteen hundred seventeen and 00/100 *dollars* ($1,917); *and for the additional expense due to changes in basement windows and brick facing, you will be allowed the extra sum of four hundred sixty-seven and* 00/100 *dollars* ($467); *leaving the net sum of fourteen hundred fifty and* 00/100 *dollars* ($1,450) *to be deducted from your contract price on account of the foregoing changes.*

Signed, John Smith Jones, Architect
Approved, Consolidated School, District of East Millville, P.M., Owner
By A. B. Hendricks, President
J. U. Petty, Clerk
Approved, J. Q. Brown, Contractor

Deduction,	$1,917
Extra,	467
Net Deduction,	$1,450

The foregoing account of these first job changes is related in detail, chiefly to impress upon the reader the importance of due formality and meticulous care in the conduct of all business transactions and the keeping of all records.* Nor can one be too diplomatic in observing due respect for the personal interests of the owner's representatives, whether these interests be proper or the reverse. In this case, the unbiased members of the board were well satisfied, and the lumber dealer was mollified for the loss of the sale of his wood lath by the assurance that the plumber would now be able to meet his note. The school principal was somewhat out of countenance, but no one appeared to censure him, and hence he was willing to bide his time, for he was beginning to harbor the idea that it would "be a feather in his cap" if he could catch the self-reliant superintendent in a serious mistake.

* Exhibit 22 on page 73 of the Handbook of Architectural Practice of The American Institute of Architects offers a proper standard form for contract changes. It contains no intimation, however, that such orders should be approved by the contractor. Such approval is of value, both as a means of forcing immediate settlement of any possible dispute regarding the terms of the order, and also as affording indisputable evidence on the subject later, in case the contractor should claim non-delivery or loss of the order or ignorance of its terms.

This series of articles by Mr. Beach, entitled "The Supervision of Construction Operations," began in the January, 1929, issue of THE ARCHITECTURAL FORUM *and continued in order in the February and April issues. In the July issue Mr. Beach will take up Chapter 7, "Foundations and Masonry Materials." The June issue is a Reference Number devoted exclusively to shops and stores, and consequently will not contain an article of this series.—The Editor.*